SOME ASPECTS OF TRAUMA AND SOFT TISSUE SURGERY IN THE DOG AND CAT

by

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Special gratitude goes to my father, brothers and sisters who continously gave me moral support and to my son Delbert for coping manfully with my absence.

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I dedicate this work to my father and late mother.

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SUMMARY

A retrospective study of 104 road traffic accident cases in the dog and cat, referred to Glasgow University Veterinary Hospital between January 1986 and December 1990, was carried out.

More than 60% of the cases were less than three years of age, with the male dog and female cat being at higher risk.

There were 11 head, 1 vertebral, 14 thoracic, 16 abdominal, 25 forelimb, 56 hindlimb and 29 pelvic injuries.

In the limbs, simple fractures occurred in 62 bones, 20 were comminuted and 5 were open fractures. The fractures were repaired with a variety of internal and external fixation techniques.

Post-operative complications developed in 13 cases; 3 - osteomyelitis, 3 - non-union, 2 - implant loosening, 2 abscesses, 1 wound discharge, 1 broken plate and 1 mal-union.

Soft tissue injuries were found in 48 cases. The regional distribution was 9 head, 13 thoracic, 16 abdominal and 10 limb injuries. There was only one complication associated with management of the soft tissue injuries. In one dog with a diaphragmatic rupture, there was dehiscence of the abdominal wound.

The presentation and management of ten cases referred to the Soft Tissue Surgery Service are described. These include; Revisional surgery following lateral wall resection failure in a dog, Persistent right aortic arch with patent ductus arteriosus in a dog, Topical enilconazole in the treatment of nasal aspergillosis in a dog, Nasopharyngeal polyps in the cat: treatment, Acquired cleft palate in a cat, Diaphragmatic rupture in a cat, Sphincter mechanism incompetence in a bitch, Temporomandibular joint ankylosis in a cat, Ectopic ureter in a bitch, Pharyngeal stick injury in a dog.

SECTION I

ANALYSIS OF 104 ROAD TRAFFIC ACCIDENT CASES

INTRODUCTION

Road traffic accidents (RTA) have been described as the most prevalent cause of trauma to pets (Al-Nakeeb 1971, Self 1971, Stead 1972, Kolata and others 1975). The range of injuries inflicted depends on the force and direction of impact, and Kolata and others (1975) reported that involvement of more than one region was common. However, that orthopaedic injuries are presented more often has been attributed to overt limb dysfunction which these injuries induce (Denny 1986). Contributing to the preponderance of orthopaedic injuries reported is the ease of radiographic interpretation of fractures (Barret 1971).

Kolata and others (1975) in a study of 600 RTA cases found that younger male dogs, below the age of three years, were frequently injured. The injuries were concentrated on extremities in 60% and the pelvis in 25% of these cases. Luxations to joints were found to involve the coxofemoral joint most frequently (5%, 31/600). In the axial skeleton, fractures of the skull accounted for 25% of injuries to the head.

Regardless of the presence or absence of traumatic shock or respiratory signs, thoracic injuries or diaphragmatic ruptures may be neglected (Al-Nakeeb 1971). Many soft tissue injuries do not require radiographs for diagnosis, yet many can be confirmed radiographically without difficulty, however the ease with which they may be overlooked because of over-penetration or poor developing technique has been recognised (Barret 1971). In one publication evaluating the radiological features of chest injuries arising from RTA in dogs and cats, over 60% showed evidence of chest injuries (Stead 1972). Of these injuries, pneumothorax and lung contusions were the most common. Other conditions which are recognised include, hydrothorax, pneumomediastinum and subcutaneous emphysema (Spackman and others 1974). Fractured ribs were a frequent finding in this report, in contrast to Kolata and others (1975) who found very few rib fractures.

Abdominal and thoracic soft tissue injuries, when severe, are the common causes of death. Kolata and others (1975) reported liver injuries in 13 dogs. Injuries to the diaphragm (9) and urinary bladder (9) were also recorded. Bladder rupture is usually fatal if not corrected. Denny (1978) reported only one bladder rupture and two urethral ruptures accompanying 123 pelvic fractures. Kolata and others (1975) found involvement of the kidney (5), spleen (3) and gastrointestinal tract (2) quite uncommon in their series of 600 cases.

Management of traumatic injuries greatly depends on the severity and location of the injury, and from the more particular anaesthetic point of view, the overall condition of the animal. Where acute thoracic injury has occurred, intervention may need to be delayed due to anaesthetic risk (Houlton 1986). Cage rest and/or chest drainage may be all that is required to manage many thoracic injuries.

In general orthopaedic injuries are managed by intervention using a variety of fixation methods (internal, external or a combination of both). Complications of fracture repair such as osteomyelitis, non or delayed union, implant loosening, degenerative joint disease and joint luxations have been reported to arise whatever the method (Vaughan 1964, Lappin and others 1983). Although arising less commonly from RTA, non union occurs most frequently in the radius of toy breeds (Vaughan 1964, Sumner-Smith and Cawley 1970), whereas osteomyelitis is associated with the femur and humerus of young medium to large breed dogs (Vaughan 1975, Stead 1984).

An analysis of 104 consecutive RTA cases was carried out to determine the distribution of orthopaedic and soft tissue injuries arising from RTA, and to assess the complications originating from management of these injuries.

MATERIALS

One hundred and four (79 dogs and 25 cats) RTA case records from January 1986 to December 1990 were extracted from the hospital databases and analysed. Each case was assessed with regards to sex, age, breed, type of injury (soft tissue or orthopaedic), body region involved, number of regions involved and number of organs injured per region.

The body was divided into seven regions namely: head, vertebral column, thorax, abdomen, forelimbs, hindlimbs and pelvis. The diaphragm was considered an abdominal organ. The radius and ulna were regarded as one bone as were the tibia and fibula for this analysis.

The time lapse from the accident to presentation at Glasgow University Veterinary Hospital, and any intervention by the referring veterinarian were noted.

Management of each case was considered and progress was assessed from recorded follow up, where this information was available. The outcome of each case was assessed eight weeks after surgery. The outcome was said to be satisfactory if the animal became sound or the severity of lameness had diminished. If the degree of lameness remained the same or got worse, this was defined as unsatisfactory. The later category was further divided into two subgroups. Firstly, those cases which, though unsatisfactory, did not develop post-operative complications. Secondly, those which developed complications, such as osteomyelitis, non or delayed union and joint changes. Those animals which developed complications had a more detailed clinical and radiographic analysis to evaluate reasons for failure. The outcome was stated as unknown where there was no information on the progress of the case.

RESULTS

1. Sex:

Male dogs outnumbered females, while in the cat the reverse was found.

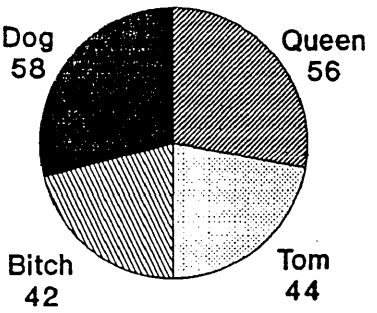

Fig. 1. Sex distribution in percentages

2. Age:

Younger animals were more at risk. In the dog, most of the cases were less than two years of age. The mean age was 3.4 years, with a range from 5 months to 14 years. In the cat, most affected animals were between the age of one and four years. The mean age was 2.1 years, with a range between 6 months and 6 years.

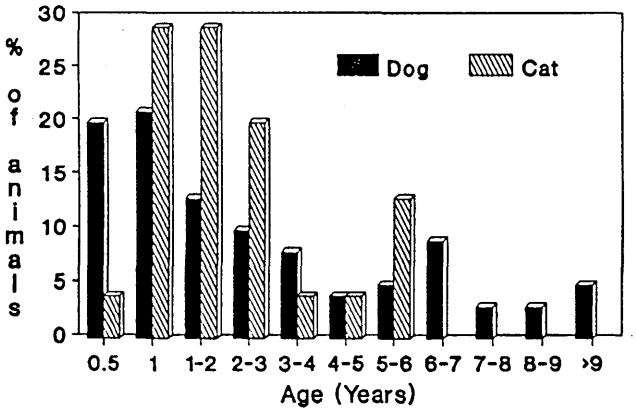

Fig. 2. Age distribution. The numbers of animals are expressed as percentages.

3. Breed:

Breed	Number of cases
Cross	18
German shepherd	13
Spaniels	9
Collies	8
Labrador	5
Terriers (others)	5
Jack Russell terrier	4
Rottweiler	4
Irish setter	3
Others*	10

Table 1. Breed distribution of dogs.

Cross bred dogs were seen most frequently. This was followed by German shepherds, spanials and collies. *The other breeds included, dachshund, deerhound, doberman (2), corgi, Hungarian viszla, miniature pinscher, poodle, shitzu and weimaraner. The giant (1) and toy breeds (1) were not well represented (Table 1). Twenty-four cats were domestic short hair and one Siamese.

4. Region:

Regions	Number of cases	
	Dog	Cat
Head	8	3
Vertebral column	1	-
Thorax	10	4
Abdomen	8	8
Forelimb	19	6
Hindlimb	43	13
Pelvis	24	5

Table 2. Regional involvement.

The number of regions involved exceeds the number of cases due to multiple regional injury in some cases. Bilateral involvement of either forelimbs or hindlimbs were counted as only one region. The limbs sustained more injuries in both species. This was followed by pelvis, abdomen, thorax, head and vertebral column with the hindlimb and pelvis notable by the number of concurrent occurrences of injury (Table 4).

5. Multiple region involvement

Number of regions	1	2	3
Dog	64	13	2
Cat	13	11	1

Table 3. Number of regions involved per case in dog and cat

Multiple region involvement occurred in 15 dogs and 12 cats. The majority were associated with the pelvic region and the hindlimbs. The triple region injuries seen in three animals involved the head, thorax and limbs. Sixteen dogs and three cats had both orthopaedic and soft tissue injuries (Table 3)

Combination (2)	number
Femur & pelvis	11
Femur & humerus	2
Femur & pneumothorax	2
Femur & head	1
Femur & pulmonary contusion	1
Tibia & pelvis	2
Humerus & pneumothorax	1
Radius/ulna & head	1
Radius/ulna & pulmonary contusion	1

Table 4. Regional combinations.

Where there were two regions involved, the hindlimb was often one of those regions. Pelvic and femur involvement was found in seven dogs and four cats. Where there were three regions involved the head was always included (Table 4).

6. Orthopaedic injuries

	Dog	Cat
Head	2	1
Vertebra	1	-
Rib	-	1
Scapula	1	-
Humerus	6	4
Elbow	5	-
Radius/ulna	10	1
Pelvis	24	5
Hip	5	-
Femur	36	16
Tibia/fibula	10	1
Foot	3	-

Table 5. Distribution of orthopaedic organ injuries per region.

Orthopaedic injuries to the head and neck were uncommon (Table 5). Fractured ribs were found in only one cat which had an avulsion of ribs eleven and twelve. None were found in the dog.

In the forelimb, the radius/ulna sustained the greatest number of fractures in the dog, compared to the cat where humeral fractures were more common. The scapula was the least commonly involved bone. Two elbow fractures and three dislocations were seen in the dog.

In the hindlimb, the femur had the highest number of fractures in both species. Foot injuries reported were only seen in the hindlimb. There were five luxated hip joints.

The pelvic injuries involving more than three pelvic bones were seen in seventeen cases in the dog and in three cats. Whereas three fractured bones or less were seen in seven dogs and two cats. Amongst the pelvic fractures, there was only one undisplaced acetabular fracture.

6.1 Fracture type

Bone	Fracture type simple	comminuted	open
Scapula	1	-	-
Humerus	9	1	-
Elbow	5	-	-
Radius/ulna	5	2	2
Femur	35	13	-
Tibia/fibula	5	3	3
Tarso-metatarsus/digit	2	1	-
Totals	62	20	5

Table 6. Type of fracture sustained to the limbs.

The fractures were defined as simple (transverse, oblique or spiral, avulsion), comminuted (several fragments) and open if there was communication with the skin surface (Table 6). The femoral head and neck were fractured in ten cases. Two of these fractures involved the articular surfaces. Epiphyseal fractures were recorded in four cases. Avulsion fractures were only associated with the greater trochanter in one cat, and collateral ligaments of the elbow joint in two dogs. In the head, an avulsion of the mastoid process was found.

Distal limb fractures involved the tibial-tarsal bone, a phalanx and an interphalangeal subluxation. The third case had crushed metatarsals.

6.2 Management

Orthopaedic cases were managed either conservatively or by surgical intervention.

Head and neck

All head and neck fractures were treated conservatively. The dog which sustained fractures of the tympanic bulla and avulsion of the mastoid process was euthanased due to severe trigeminal nerve deficit. The eventual outcome of the other three was not known.

Thorax

The avulsed ribs in the cat were associated with a diaphragmatic rupture. They were removed and the diaphragm advanced to rib 10. The recovery was uneventful.

Forelimb

The scapular fracture was managed conservatively due to the long-standing nature of the fracture and radiographic evidence of fracture healing. All other fractures were treated surgically. The two elbow dislocations with avulsions of the collateral ligaments were repaired by anchoring the ligaments to the humeral condyles. Closed reduction was done in two other cases. An olecranon fracture was repaired with Kirschner and tension band wires.

Pelvis

The five pelvic fractures in cats were all managed by cage rest. The outcome was unknown. Canine pelvic fractures with minimal fracture displacement and not involving the articular surfaces were candidates for conservative treatment. Of the eighteen cases that were managed by intervention, the acetabulum was plated in two cases, five eventually had excision arthroplasty following failed fracture reduction. Seven cases had the fractures of the ilium aligned with plates. Lag screws were used to reduce two sacroiliac luxations. Analgesics and antibiotics were given to all cases that were treated surgically. Eight weeks post-operatively, the outcome was satisfactory in three cases, unsatisfactory in two, both having developed complications. The outcome was not known in nineteen cases.

Hindlimb

All hindlimb fractures and dislocations were treated surgically. One cat with a femoral fracture died before surgery because of adult respiratory distress syndrome, and hepatic necrosis was found at necropsy. Closed reduction was used in four hip dislocations, and one was stabilised with a transarticular pin. The remaining four femoral head/neck fractures had excision arthroplasty. Bone grafting and osteotomy were performed in two comminuted fractures of the femur. An external fixator coupled with bone grafting was used on a open tibia/fibula fracture. Rush pins were used as sole fixation in nine distal epiphyseal fractures and an intramedullary pin was used as the sole fixation in four femurs. Plates were generally used with lag screws. Five

femur and three tibia/fibular fractures were repaired by plating only. In both the hind and the forelimbs intramedullary pinning was supported with cerclage wires.

6.3 Fixation type

	IM pin[1]	Internal plate	lag screw	others[2]	External	Both
Humerus	5	4	-	1	-	-
Radius/ulna	2	5	-	-	2	2
Femoral head/neck	-	-	2	4	-	-
Femur	10	8	3	10	-	-
Tibia/fibula	-	6	1	2	1	1
Tarso-metatarsus/ digit	-	-	1	-	1	-
Total	17	23	7	17	4	3

1. IM= intramedullary pin. 2. others= Rush pin, cross pins, Kirschner wire.

Table 7. Type of fixation.

Plates were used as the sole fixator in four simple fractures of the radius/ulna and two humeral fractures. Rush pins were used in a femoral epiphyseal fracture, and an undistracted radius/ulna fracture was immobilised with plaster of Paris. External fixators were used to stabilise two radius/ulna open fractures and one tibia/fibula comminuted fracture.

6.4 Result of treatment

	satisfactory	lame	complications	unknown
Scapula	1	-	-	-
Humerus	7	-	1	2
Elbow	3	-	-	2
Radius/ulna	3	1	4	3
Pelvis	3	-	2	24
Hip	2	2	-	1
Femoral head and neck	-	-	-	10
Femur	7	2	4	13
Tibia/fibula	2	2	2	5
Tarso-metatarsus/ digit	-	1	-	2
Total	28	8	13	62

Table 8. Outcome of treatment eight weeks after surgery.

Post-operative complications were recorded in 10% of the humerus fractures, 36% radius/ulna, 15% femur and in 18% tibia/fibular fractures (Table 8).

6.5 Cases that developed complications (see Table 9)

Sixty-seven per cent (9) of all the cases that developed complications were presented to GUVH within two days of the accident while 31% (4) were presented more than seven days after the accident. Two dogs had already had fixation attempted by the referring veterinary surgeons. Dog 4 was presented 21 days after with a delayed union, after attempted reduction of the fracture using plaster of Paris. The fracture was stabilised with a plate and screws, but subsequently developed osteomyelitis (Figs. 3-5). Dog 5 was presented eight days after the accident. An attempt by the referring veterinarian to reduce the fracture with an IM pin without prior radiography was a failure (Figs. 6,7). Case 9 was an example of a plate which was too small and therefore not strong enough to support the fractured femur (Fig. 8). A non union arose in dog 10, which had had an open fracture of the tibia/fibula repaired with a plate (Fig. 9). However, no further treatment was instituted because an alimentary lymphoma was detected at this stage, and the dog was euthanased.

	Species	Breeds	Sex	Age	TAR	Bone	Fracture type	Fixation	Complication	Op time
1	Dog	doberman	M	2	1	humerus	comminuted	plate	mal-union, sinus	2
2	Dog	lurcher cross	FS	3	1	radius/ulna	open	external fixator	non union, sequestrum	2.33
3	Dog	border collie	F	10	1	radius/ulna	comminuted	plate, cerclage wire	osteomyelitis	2
4	Dog	Weimaraner	M	1	21	radius/ulna	comminuted	plate	osteomyelitis	1.33
5	Dog	German shepherd	M	1	8	femur	comminuted	plate, lag screw	osteomyelitis	1.5
6	Cat	DSH	FS	1	1	femur	simple, distal	lag screw, Kirschner wire	implant loosening	3.33
7	Dog	cross	M	0.5	7	femur	simple, oblique	IM pin	non union	2
8	Dog	cross	F	0.4	1	femur	simple, distal	Rush pins	abscess	1.75
9	Dog	pinscher miniature	F	0.5	2	femur	comminuted	plate	broken plate	3
10	Dog	cross	FS	14	2	tibia/fibula	open	plate	non union	2.75
11	Dog	cross	M	0.6	1	tibia/fibula	Salter Harris II	cross pins, cast	implant loosening	1.5
12	Dog	cross	F	2	14	pelvis	mulitple	cerclage wire (ilium)	abscess	1.5
13	Dog	Irish setter	F	0.6	1	pelvis	multiple	plate (acetabulum)	wound discharge	-
				years	days					hours

Table 9. Complications that developed 8 weeks following surgery

TAR- time from accident to referral

Fig. 3. Pre-operative lateral radius/ulna (case 4) Reduction of this fracture was attempted using plaster of Paris 3 weeks prior to referral. A fracture of the distal third of the radius and ulna can be seen. Callus has formed at the ends of the fragments but is not bridging the fracture. Note the marked soft tissue swelling.

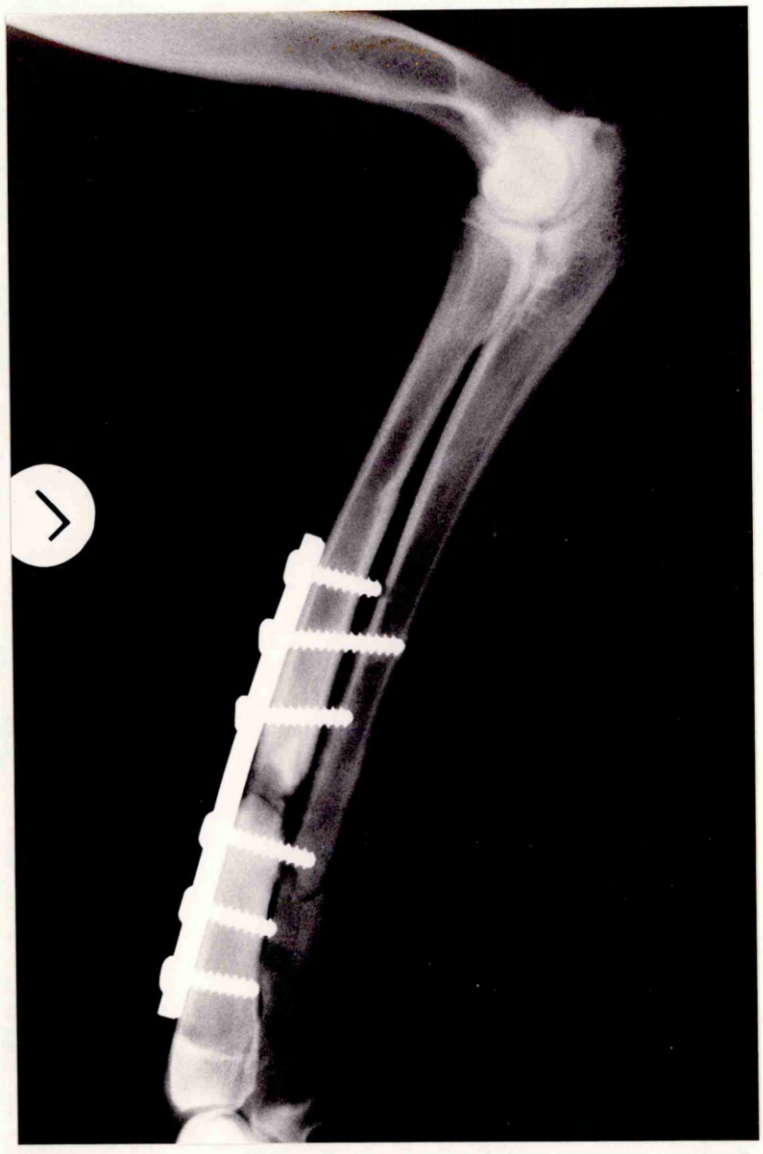

Fig. 4. Post-operative lateral radius/ulna (case 4) Good reduction and alignment has been achieved by the use of a six holed plate placed on the cranial surface of the radius.

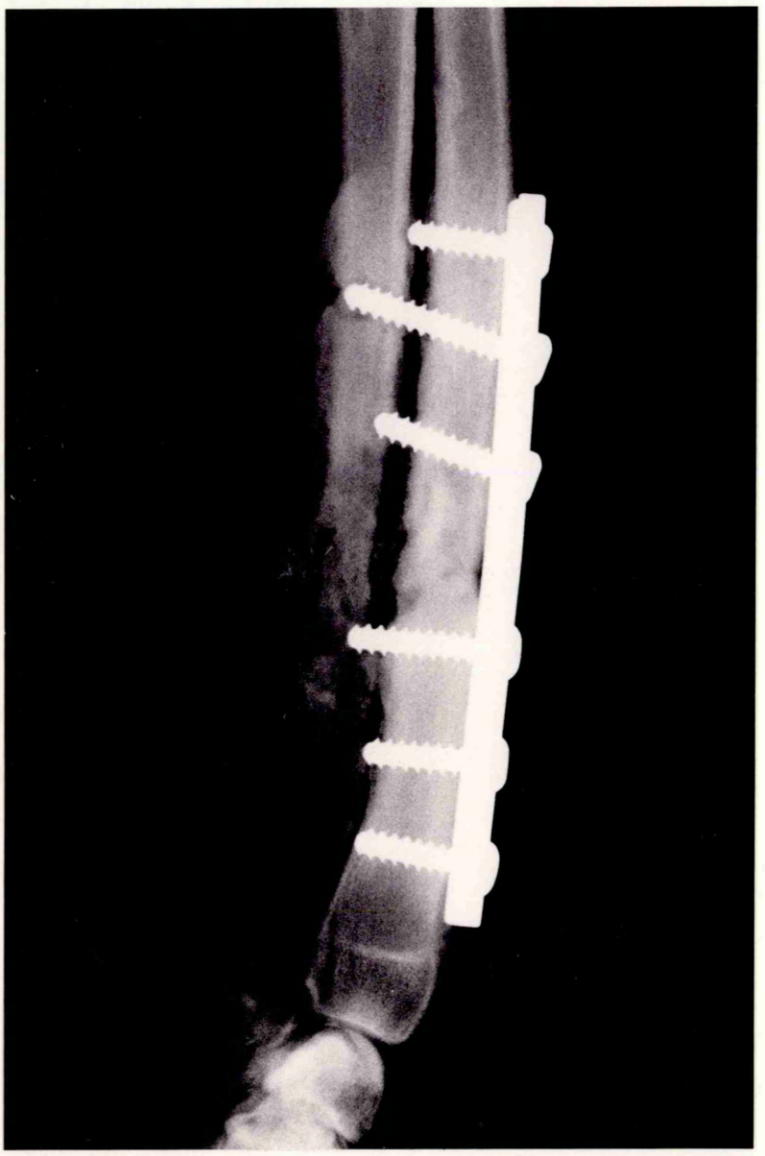

Fig. 5. Osteomyelitis. Lateral radius/ulna (case 4) Fracture lines are indistinctly visible and there is a fluffy periosteal reaction around the radius and ulna, with production of exuberant new bone. There is bone lysis around the second screw.

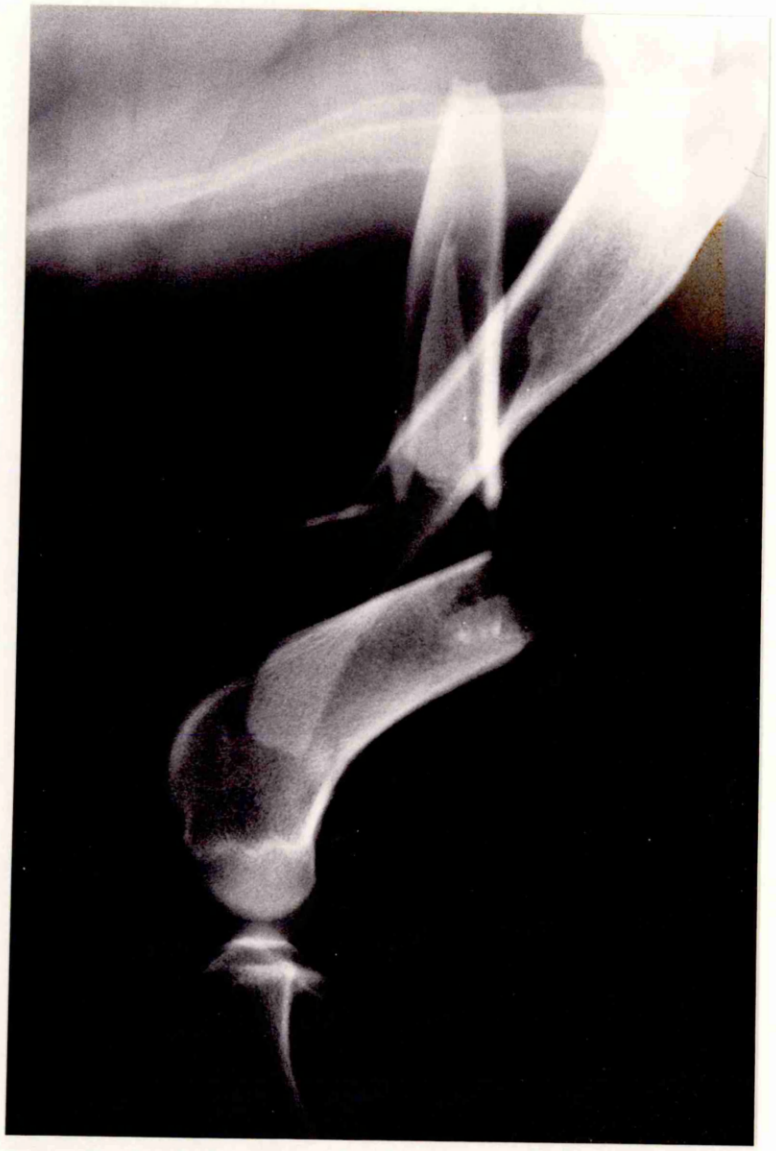

Fig. 6. Lateral femur (case 5) There is a comminuted fracture of the femur with pronounced displacement of the fragments. An unsuccessful attempt to repair this fracture by the referring surgeon led to a delay in subsequent corrective surgery.

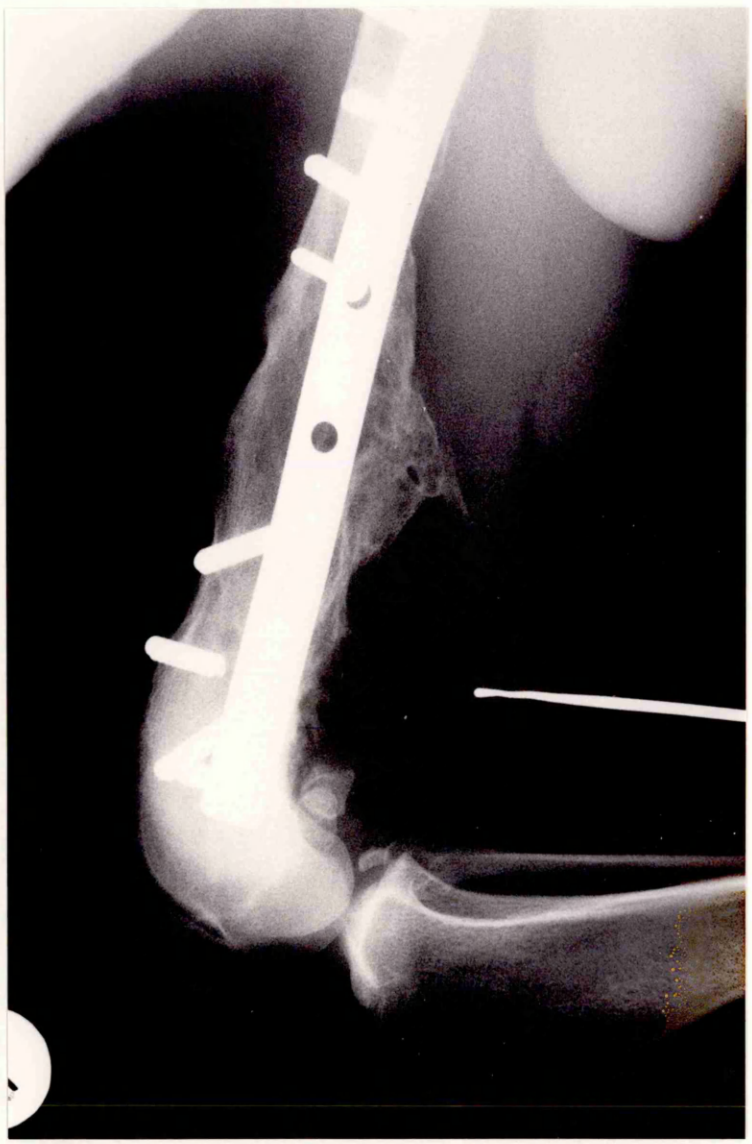

Fig. 7. Osteomyelitis. Lateral femur (case 5) Ten months following repair, the fracture line is no longer visible. However, there is a fluffy periosteal reaction and sclerosis at the distal end of the bone. One screw is broken. There also appears to be some widening and increased lucency of the medullary cavity. A probe has been introduced to delineate a discharging sinus.

Fig. 8. Cranio-caudal femur (case 9) The fracture line can be seen with angulation of the bone. A relatively small plate with only two screws fixed to the distal fragment has been used to repair this comminuted fracture. This is likely to be the cause of of the plate breaking.

Fig. 9. Non union. Lateral tibia. (case 10) The proximal tibial fracture has been repaired with a seven hole plate and screws. The fracture line is rather wide and the ends are sclerosed. Although there is evidence of new bone formation, there is a lack of active periosteal response.

7. Soft tissue injuries

In the 104 dogs and cats a number of soft tissue injuries were detected. Injuries to the head (skin lacerations, bruises, haemorrhage, eye proptosis) were seen in eight dogs and one cat. Thoracic injuries (pneumothorax, pulmonary contusion) were detected in ten dogs and three cats (Figs. 10-13). The thoracic injuries in all cats and in five of the dogs were associated with orthopaedic injuries. The diaphragm was the most frequently injured abdominal organ in both species. Abdominal ventral muscle wall ruptures were found in a dog and a cat.

Skin lacerations and bruises usually occurred in the limbs. In these cases, there were concomitant orthopaedic injuries (Table 10). Degloving wounds were rarely seen (1 dog and 1 cat).

Organ	Dog	Cat
Head		
haemorrhage (eyes, nose, ear, mouth)	3	-
eye proptosis	1	-
skin (lacerations, bruising)	4	1
Thorax		
pneumothorax	6	2
pulmonary contusion	3	-
more than 1	1	1
Abdomen		
diaphragmatic rupture	7	7
ventral abdominal wall rupture	1	1
Limbs		
degloving wounds	1	1
skin (lacerations, bruising)	7	1

Table 10. Distribution of soft tissue organ injuries.

7.1 Interval to presentation (diaphragmatic ruptures)

The time from the occurrence of the accident to presentation varied from only two days to eighteen months.

In those animals with diaphragmatic ruptures the intestines were herniated in 9/14 (64%) cases while stomach, spleen and liver were involved in seven (50%) cases each. More adhesions were discovered in the cat (3) than in the dog (1) and in all the four cases the liver was herniated. However there was no relationship between the time the accident occurred to referral and the herniated organ (Table 11), (Figs. 14,15).

	TAR*	liver	spleen	omentum	GIT*	kidney	adhesions
Dog							
1	2 days	-	+	-	+	-	no
2	1 week	+	-	-	+	-	no
3	1 week	-	-	-	-	-	no
4	3 weeks	-	-	-	-	+	no
5	2 months	-	+	-	+	-	no
6	12 months	+	+	-	+	-	no
7	unknown	+	+	+	+	-	yes
Cat							
1	3 days	-	-	-	-	-	no
2	3 days	-	-	+	+	-	no
3	17 days	+	+	+	+	-	no
4	3 weeks	+	-	-	-	-	yes
5	7 weeks	-	-	-	+	-	no
6	6 months	+	+	+	+	-	yes
7	18 months	+	+	+	+	-	yes

* TAR = time from accident to referral, GIT = gastrointestinal tract.

Table 11. Time between accident and referral, and the type of organ herniated.

7.2 Management

Skin injuries, most being more than a day old, were managed as open wounds. The prolapsed eye was enucleated. The thoracic injuries, pneumothorax and pulmonary contusion, were managed by either resting (11), or by chest drainage (2). All abdominal injuries were repaired surgically. A right middle lobe torsion was found in one dog with a diaphragmatic rupture, following removal of the intrathoracic abdominal organs. This animal had a thoracotomy to remove the lobe. Standard repair was done in the rest of the animals with diaphragmatic ruptures. Air or/and fluid were drained from the chest after the surgery using an intravenous catheter and three way tap. Only the dog with the lobectomy had a chest drain implanted for 24 hours.

Results of treatment

All thoracic injury cases recovered and all diaphragmatic ruptures were discharged. Wound breakdown of the abdominal incision occurred in one dog a week post-operatively. An enterectomy was done because of adhesions of the small bowel to the linea alba. Both animals with ventral abdominal wall ruptures were satisfactorily repaired.

8. Anaesthesia

Orthopaedic cases were given routine anaesthesia, which involved premedication with acetylpromazine and pethidine, induction with either propofol or thiopentone, and maintenance was achieved with a mixture of halothane, nitrous oxide and oxygen. Atropine was given routinely to cats.

Special attention was given to anaesthesia of diaphragmatic ruptures and thoracic injuries. Pre-oxygenation was done in two cats. Nitrous oxide was not used in eleven cases. A muscle relaxant was utilised in three dogs and reversed with neostigmine. Intermittent positive pressure ventilation (IPPV) was used in all diaphragmatic rupture repairs. In small dogs this was done manually, and in large dogs by machine. Antibiotics, analgesics and fluids were given routinely during or/and after the surgery.

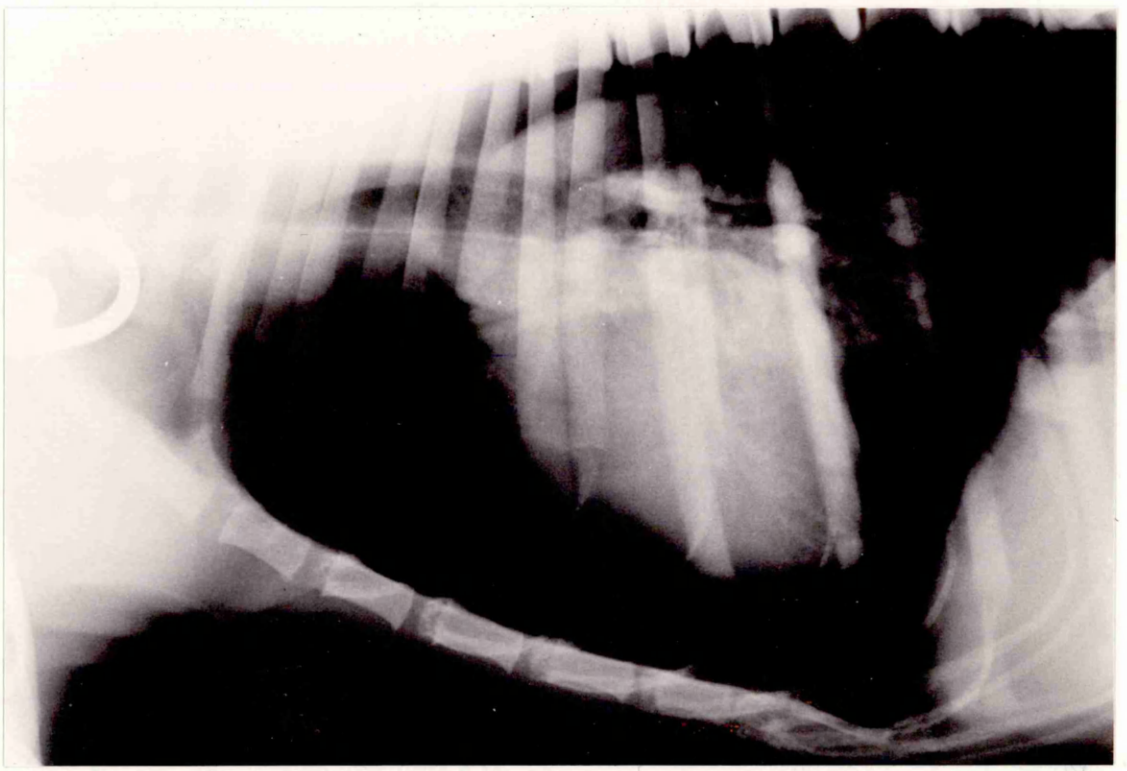

Fig. 10. Pneumothorax. Lateral thorax. There is an overall increase in radiolucency in the thorax, with a loss of peripheral lung markings. The cardiac shadow has been lifted from the sternum. Dog 45 (Appendix 2)

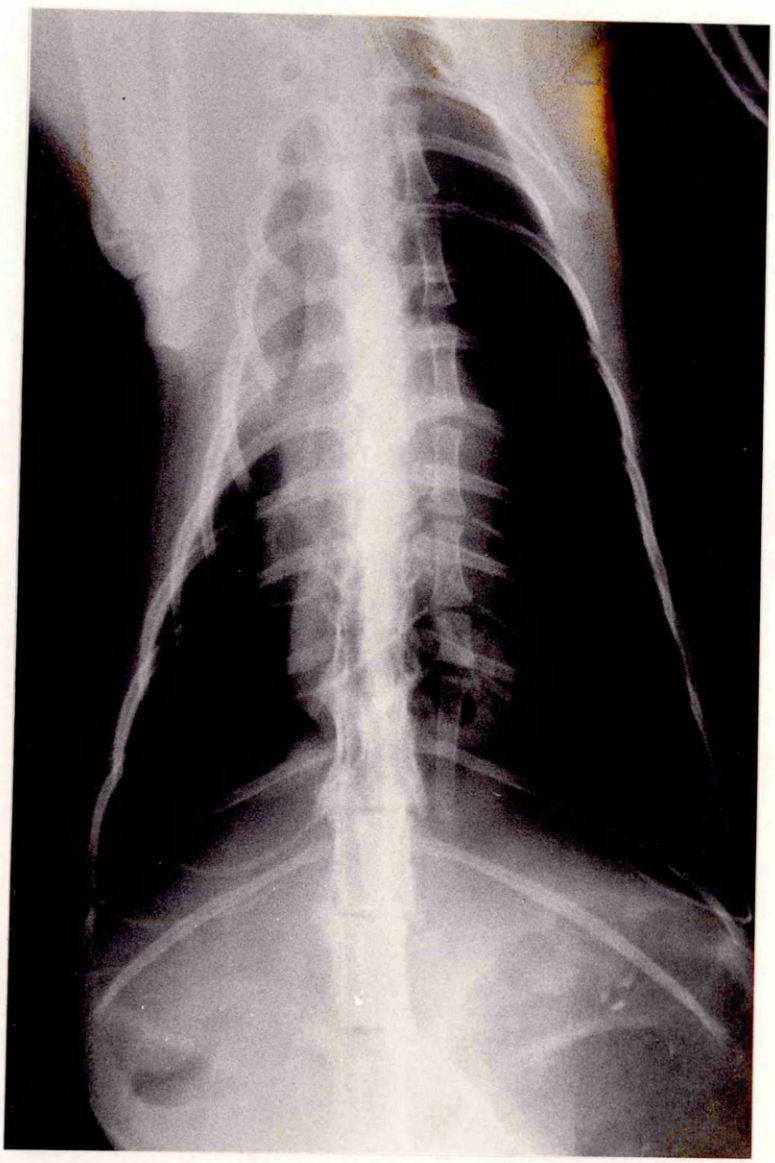

Fig. 11. Pneumothorax. Dorso-ventral thorax. There is a very marked bilateral increase in radioluceny peripherally with absence of lung markings indicating a pneumothorax. The left crus of the diaphragm is perhaps somewhat flattened suggesting respiratory distress. (same animal as fig.10)

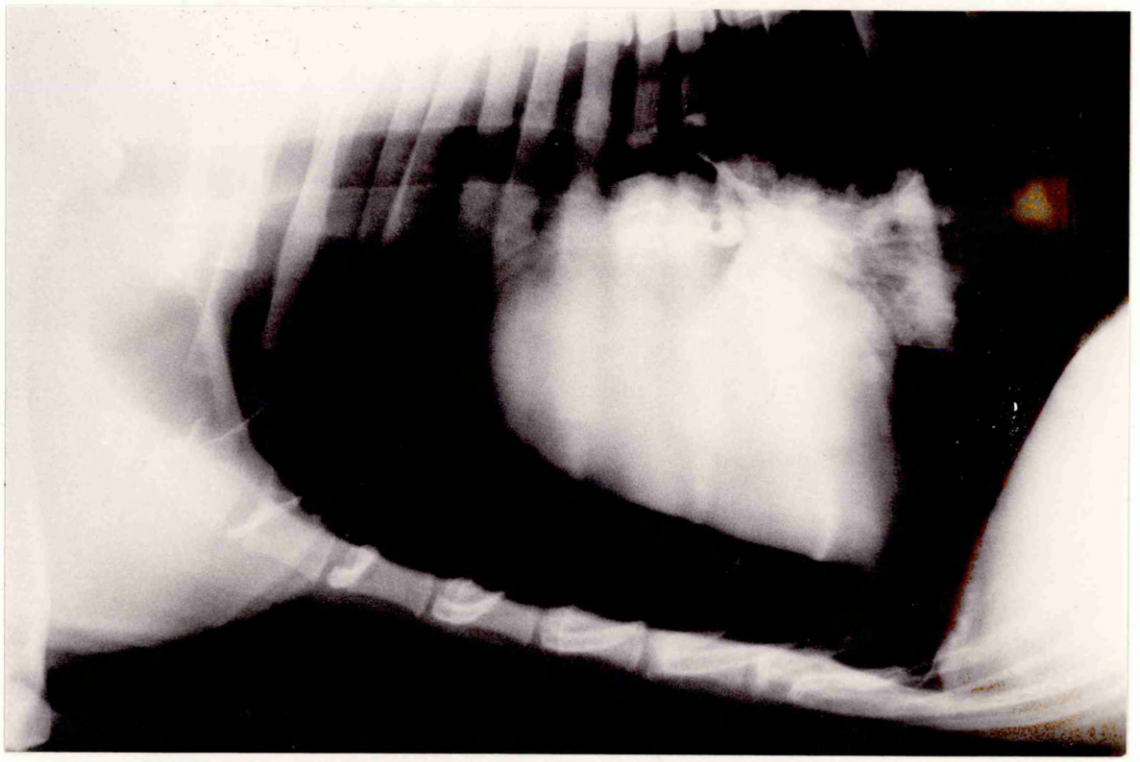

Fig. 12. Pulmonary contusion. Lateral thorax. The cardiac shadow is elevated from the sternum and the lung lobes are collapsed. The cardiac shadow is perhaps more radioopaque than normal. Dog 29 (Appendix 2)

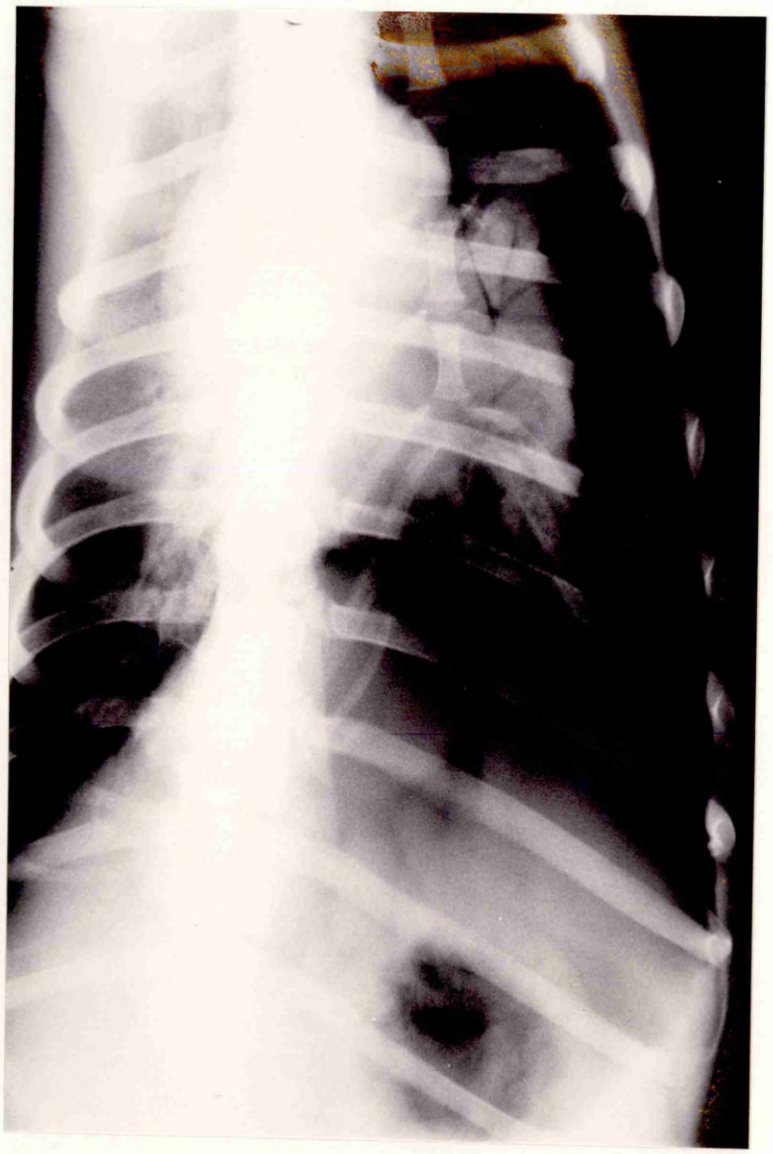

Fig. 13. Pulmonary contusion. Dorso-ventral thorax. (same animal as Fig. 12). This view confirms the pneumothorax seen on the lateral view. In addition, air bronchograms can be seen within the consolidated lung lobes.

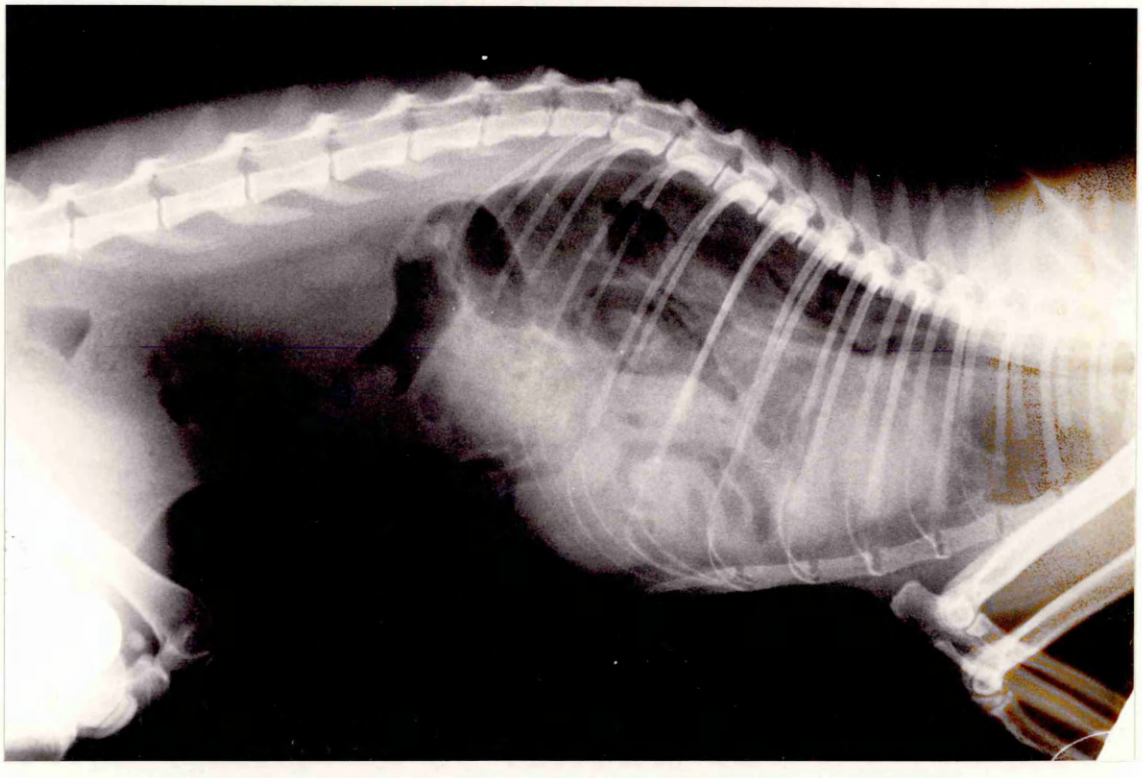

Fig. 14. Diaphragmatic rupture. Lateral thorax and abdomen. The diaphragm cannot be outlined with absolute clarity. The abdomen is rather empty and there is cranial displacement of the remaining viscera. There are gas filled loops of bowel obscuring the lungs and heart. Cat 9 (Appendix 2)

Fig. 15. Diaphragmatic rupture. Dorso-ventral thorax and abdomen. (same animal as Fig. 14). In this view the abdomen appears empty and is demonstrating a wasp waist appearance. The normal contents of the thorax are masked and loops of bowel can be seen laterally.

DISCUSSION

It might be argued that 104 RTA victims in five years was a rather small number considering the annual surgical case-load (2000). There are a number of possible explanations for this. Firstly, not all RTA victims will require or reach a referral centre, as some may have minor injuries. Secondly, some have such severe injuries that euthanasia is carried out by the primary veterinary surgeon. Thirdly, the cause of trauma may not have been observed by the owner, or recorded by the admitting veterinary surgeon, so that these cases would not be extracted when querying the databases.

Kolata and others (1975) found that young male dogs of the medium to larger breeds were predominantly involved as victims. The results of this series are no different (Figs. 1,2.). Possible explanations for this predisposition are that young animals are more likely to roam and to explore an unknown environment, whereas toy and giant breeds are less likely to be permitted to wander unsupervised. However, there is no explanation for the apparent female cat predominance. The greater number of cross bred dogs might reflect the general population from which this centre draws its caseload. The type of owner who obtains a mongrel is less likely to take the same care over their pet compared to those who spend more money on obtaining and looking after a pure bred dog. Indeed, many of these mongrels from large housing estates are frequently "latch-key "dogs.

Orthopaedic injuries easily outnumbered soft tissue injuries. There were 122 fractures, 29 of these involved the pelvis. Of the 87 limb injuries 62 were simple, 20 comminuted and five open fractures.

Injuries to the head were not encountered frequently in this series. This may be because injuries such as damage to the turbinates, which lead to epistaxis, are seen acutely but resolve quite rapidly. Calvarial fractures may be uncommon compared to man, because the canine skull is thicker and relatively smaller, and the more subtle manifestations of brain injury which result in man are not detected in the dog and cat. In the head, a common sequel to trauma are mandibular fractures. Umphlet and Johnson (1988) found that 50% of mandibular fractures in a large series of 62 cats arose as a result of a RTA. However, these are generally dealt with by practitioners, unless accompanying more serious injuries such as diaphragmatic rupture (Phillips 1979). Although only a few animals had more than two regions damaged, these few always sustained injury to the head.

The ribs and the scapula are protected by the ability of the ribs to deform and absorb the energy of impact, rather than fracture (Kolata and others 1975). This serves to explain the rarity of injury to these structures seen in this series. Indeed, the forelimb was spared the frequency of injury sustained by the hindlimb.

In the forelimb, the radius and ulna were those bones most often fractured in the dog (Table 4). Three of the ten animals developed complications, in contrast to only one humeral complication. Although two of the radius and ulna fractures were open, only one subsequently developed osteomyelitis. The other case of osteomyelitis in the radius and ulna had had previous surgical intervention. However, Vaughan (1975) found that the type and duration of fracture appeared to play no part in the potential development of osteomyelitis. Further, Stead (1984) recorded osteomyelitis arising in the humerus much more frequently than the radius and ulna. Taking fractures as a whole, elbow fractures are common. However, these arise in toy breeds particularly, and in general, are not caused by RTA (Phillips 1979, Cockett and Clayton-Jones 1985).

The hindlimb, as defined for this study, excluded the pelvis. Seventy- one per cent of the fractures to the limbs involved the hindlimb which is very similar to that reported by Kolata and others (1975). Four of the animals sustained bilateral femoral fractures making ambulation and rest after repair difficult. Pelvic and femoral fractures were often seen together. Where two regions were involved, the femur was often one of the injured bones. This might be explained by the position the animal assumes when being hit and when making subsequent impact with the ground. These results tends to show the artificiality of separating the pelvis from the hindlimb.

Compared to the total number of fractures occurring in the hindlimb, no more complications arose in this region than would have been expected. The type of complications were those generally anticipated following fracture repair (Vaughan (1975). As in the forelimb, the open fracture found in the hindlimb involved the distal part of the limb, probably due to the lack of soft tissue cushioning found more proximally.

There were 48 soft tissue injuries. As one might expect damage to the skin occurred more frequently on the limbs and occasionally on the head. All these cases had concomitant orthopaedic injuries.

Thoracic injuries were found in 10 dogs and three cats. Simple pneumothorax and pulmonary contusion were encountered and were easily recognisable radiographically (Stead 1972). These were treated by simple cage rest. Nine of the 13 animals had also orthopaedic injuries, which is not dissimilar from that reported by Spackman and others (1984), when looking at the results of 267 dogs which had sustained fractures arising from RTA. The bulk of the orthopaedic injuries co-existing with thoracic injuries occurred to the caudal half of the body. This is in agreement with the results reported by Selcer and others (1987), but contrary to those reported by Kolata and others (1975).

Apart from diaphragmatic ruptures, detectable abdominal injury was not common. In man, the spleen and liver are very commonly injured (Goins and others 1990). Dorn (1987) considered urinary tract trauma, such as rupture of the ureter and bladder to be a common occurrence secondary to RTA. One author argument advanced for this was that the urinary system is intimately associated with the skeletal structures such as the pelvis. However, Denny (1978) only found three animals with urinary tract trauma in a series of 123 pelvic fractures. No cases of urinary tract trauma were encountered in this group of animals. This is perhaps because only those animals which survived the initial trauma were referred, and those which died were not included in this series, or were not necropsied (Kolata and others 1975). Rarer injuries associated with the hepatic system have been reported to involve the biliary tree (Watkins and other 1983, Donald and others 1985).

Diaphragmatic rupture is a well recognised sequel to RTA (Walker and Hall 1968, Garson and others 1980, Sullivan and Reid 1990). The diaphragm was considered as an abdominal organ in this series since rupture occurs as a result of a "blow" to the abdomen, forcing the abdominal contents through the rent. The relatively large number of diaphragmatic ruptures in this series may be explained by the fact that private practitioners may not be confident about tackling repair, or have adequate anaesthetic facilities to meet the challenge of the anaesthetic risks involved. In this series all the ruptures were discharged satisfactorily, and none had developed further problems on follow-up.

In comparison to animals with soft tissue injuries, those with orthopaedic injuries were also discharged satisfactorily. However, a perfect surgical repair to bone is more likely to fail from poor or negligent post-operative management, which is in the hands of the owner.

The orthopaedic complication rate was acceptably low in this series. However, the number of animals not followed up, or lost to follow-up may artificially be giving better results than is actually the case. It would seem that this is an area which would benefit from improvement.

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SECTION II

Case 1

REVISIONAL SURGERY FOLLOWING LATERAL WALL RESECTION FAILURE IN A DOG

INTRODUCTION

The ear can be divided into three distinct anatomical divisions. Similarly the inflammatory conditions affecting the ear are also, nominally, divided into otitis externa, media and interna. It is estimated that the incidence of otitis accounts for 10 per cent of veterinary professional time (Lane 1976) and otitis externa is the commonest manifestation of ear disease in the dog and cat.

The pathophysiology of otitis externa is complex and by the time the animal presents for treatment the initial cause may not be apparent. Breeds with characteristic ear conformation, such as long eared dogs (spaniel), and breeds with excessive hair in the ear canal (such as the poodle) are very prone to otitis externa (Lane 1982, Tufvesson 1955, Matthiesen and Scavelli 1990). The reason is considered to be restricted air circulation creating a moist environment. In contrast, amongst the dogs with an erect pinna, the German shepherd has been reported to be susceptible to otitis media. The association between otitis externa and media via the tympanic membrane is well established, but Lane (1976) has stated that ascending infection via the eustachian tube contributes markedly to otitis media especially in German shepherd dogs. Pain, rather than head tilt, is the major sign of otitis media (Parker and others 1976, Scott 1979). However the evidence for ascending infection is rather weak and has been refuted recently by Little (1988).

It is generally accepted that trigger factors play an important role in precipitating otitis externa in both dogs and cats. Foreign bodies - grass awns, hair, debris, parasites - mites, ticks, biting flies in the external ear will cause an initial irritation leading to an inflammatory response of the aural integument (Scott 1979, Lane 1982). Factors such as bacteria are believed to be commensals and therefore unlikely to be primary causal agents. However, they have been found to increase in numbers in favourable conditions produced by inflammation (Fraser 1969, Lane 1982). *Proteus*, *Pseudomonas*, *Staphylococcus* and ß-haemolytic *Streptococcus* have been recovered from diseased ears (Scott 1979, Smeak and DeHoff 1986, Lane 1989). Moisture predisposes to the yeasts *Pityrosporum canis* and *Candida albicans* (Scott 1978).

Since the ear integument is merely a modified skin of stratified squamous epithelium with sebaceous and modified apocrine glands, it is just as susceptible to dermatitis as any other part of the body. Scott (1978) noted the frequent occurrence of ceruminous otitis externa in association with generalised seborrhoea. Dermatological lesions were identified in 64 per cent of 71 dogs with chronic irreversible ear change, and included seborrhoeic changes, atopies, demodectic

infestation and hypothyroidism (White and Pomeroy 1990). Consequently, it is argued that emphasis should be placed on the skin problem as a whole in management of ear disease.

Neoplasia as a cause of otitis externa is uncommon in dogs (Little 1989), though the range of ceruminous abnormalities in the cat are well recognised (Lane 1982).

When managing ear conditions, consideration must be given to the cause, duration and involvement of the outer, middle and inner ear. For many years surgical intervention has been used in an attempt to solve medically unresponsive otitis externa through improvement of ear canal ventilation and drainage. The angulation of the ear canal poses difficulties in ventilation via the external ear opening, while the position of the eustachian tube does not afford adequate bulla drainage.

Surgical drainage of the ear canal was first advocated by Hertwig as early as 1853 (Harvey 1980). In 1949, Zepp introduced a lateral wall ear resection incorporating a baffle plate. Tufvesson (1955), Gregory and Vasseur (1983) used the modified Zepp's procedure as their main surgical method. Tufvesson (1955) achieved better results with 45.5% complete recovery, while Gregory and Vasseur (1983) achieved 41% success. Post-operative complications in both reports included stenosis of the horizontal ear canal, dehiscence and ulceration.

Fraser and others, in 1961, described resection of the entire vertical canal. This was aimed at removing hyperplastic tissues and tumours of the vertical canal, thus leaving a patent aperture at the horizontal canal/skin junction. This method was later modified by Lane (1982) to incorporate a baffle plate ventrally.

A further modification of vertical canal ablation was suggested by Tirgari and Pinniger (1986). This pull-through technique for vertical canal ablation was considered more advantageous because it produced less trauma, fewer sutures and reduced wound edge separation.

Total ear canal ablation (TECA) was mentioned by Tufvesson in 1955, but this method was not widely used because it prevented external drainage via the tympanum, leading to deep-seated abscess formation, hence worsening the condition (Fraser 1969).

A high incidence of complications, particularly facial nerve paralysis, fistula formation, wound infection have been reported after TECA (Smeak and DeHoff 1986), and recently in total ear canal ablation with lateral bulla osteotomy (Beckman and others 1990, Matthiesen and Scavelli 1990, White and Pomeroy 1990).

Inflammatory diseases of the middle ear have been managed by myringotomy or bulla osteotomy (Lane 1982). The need for bulla osteotomy was first appreciated following the 1917-1921 outbreak of swine flu and complications of otitis media in calf, dog and cat (McNutt and McCoy 1930).

The concept of total ear canal ablation combining lateral bulla osteotomy (TECA LBO) was reported by Schwartz in 1983. Recently successful results of TECA LBO have been reported by Matthiesen and Scavelli (1990) in 32 dogs with end-stage otitis and neoplasia of the horizontal canal. The results were excellent in 21 dogs, good in 12 and poor in 3. Beckman and others (1990) reported success in 40 out of 42 dogs, though they had high percentage of post-operative complications. White and Pomeroy (1990) had a 92% success in resolving aural conditions in 71 dogs. Complications have been attributed to lack of surgical experience and expertise. Post-operative complications identified in the three reports involved facial nerve paralysis, vestibular injury, impaired hearing and retroglenoid haemorrhage.

Once presented with a case of ear disease a decision has to be made whether to treat medically or surgically. This should be done after a thorough examination of the patient. Topical treatments are usually adequate in early stages with no severe pathological changes. However if vigorous medical therapy fails to resolve the condition, surgical treatment is then indicated. The surgical method to be used depends on the gravity of the disease, which is determined by the history, clinical findings, and taking into consideration skin involvement. Failure to make the correct choice, initially, may lead to revisional surgery being necessary later.

CASE DETAIL

History

A five-year-old male Bouvier des Flandres dog was presented to the Glasgow University Veterinary Hospital (GUVH) with a history of persistent infection of the left ear.

Four months before presentation to GUVH, a lateral wall ear resection was carried out by the referring veterinarian. The owner reported that there was noticeable improvement for a couple of weeks, after which the clinical signs of otitis externa (head shaking, otorrhoea, head tilt) recurred. A swab had been taken from the affected ear for culture and sensitivity, and *Proteus* and a ß-haemolytic *streptococcus* were isolated. The *Proteus* was sensitive to the following antibiotics: ampicillin, penicillin, streptomycin, neomycin and synulox. The ß-haemolytic *Streptococcus* was sensitive to broad spectrum antibiotics. Trimethoprim-sulphonamide was prescribed for two weeks. There was noticeable response to the medication. Clinical signs of otitis externa recurred a few days after the end of medication. At presentation, the owner reported that head shaking and scratching had worsened and there was deterioration in hearing.

Clinical Findings

On physical examination, the horizontal ear canal opening was patent with a foul smelling pus discharge draining down the baffle plate. The baffle plate and some parts of the medial wall of the vertical canal were very inflamed with areas of ulceration and bleeding (Fig C1.1).

Diagnostic Aids

Dorso-ventral and open mouth views of the skull revealed ossification of the annular cartilage and stenosis of the horizontal ear canal (Fig C1.2). Tympanometry was not available for this case.

Treatment

In view of the history, physical and radiological findings total ear ablation combining lateral bulla osteotomy (TECA LBO) was indicated.

Routine anaesthesia was used (Appendix 1) and the area around the left ear was prepared for surgery. The dog was positioned in right lateral recumbency and a sandbag was placed under the neck. Sterile drapes were used to isolate the surgical areas.

A skin incision was made on the inner aspect of the pinna to include the inflamed and ulcerated tissue, as well as the medial wall of the vertical ear canal. The incision was extended ventrally on either side, lateral to the previous incision encompassing the baffle plate.

The medial wall of the vertical ear canal was freed from surrounding soft tissue by bluntly dissecting close to the perichondrium. The baffle plate was undermined and dissection was continued around the horizontal ear canal until the bulla could be felt. The facial nerve was identified and was isolated using hand held retractors. The horizontal ear canal was transected at the external acoustic meatus. Haemorrhage up to this point was controlled using haemostats.

Muscle retractors were used to retract tissues and the facial nerve and hence making the bulla visible. Using rongeurs, a defect was made in the bulla by breaking and removing pieces of the bulla wall. Profuse haemorrhage from the retroglenoid vein occurred at this stage. This haemorrhage was patiently arrested by digital swab pressure after suction of the blood from the surgical site.

The tympanic cavity was carefully curetted to remove the middle ear lining. This was followed by flushing with normal saline and suction of the cavity to remove debris. The skin on either side of the incision was undermined to mobilise it for closure. The subcutaneous stages were opposed with 2-0 vicryl to reduce the dead space. The skin was closed in a 'T' shape with simple interrupted pattern using 2-0 nylon.

The dog was given analgesics and antibiotics at the start of the operation. Analgesics were repeated immediately post-operatively.

Follow up

Immediately post-operatively, facial nerve paralysis was apparent with palpebral reflex deficit. There was marked swelling associated with the surgery on the ventral neck. On the third day, the palpebral reflex was subtle indicating some improvement.

The dog was seen ten days later. The wound had healed well and the swelling had subsided. No discharge was seen and the sutures were removed. The owner considered the presenting signs had largely abated. The palpebral reflex had returned to normal.

Fig. C1.1. Ear. A lateral wall resection was carried out four months previously, note the ulceration, bleeding and marked crusting of the hair.

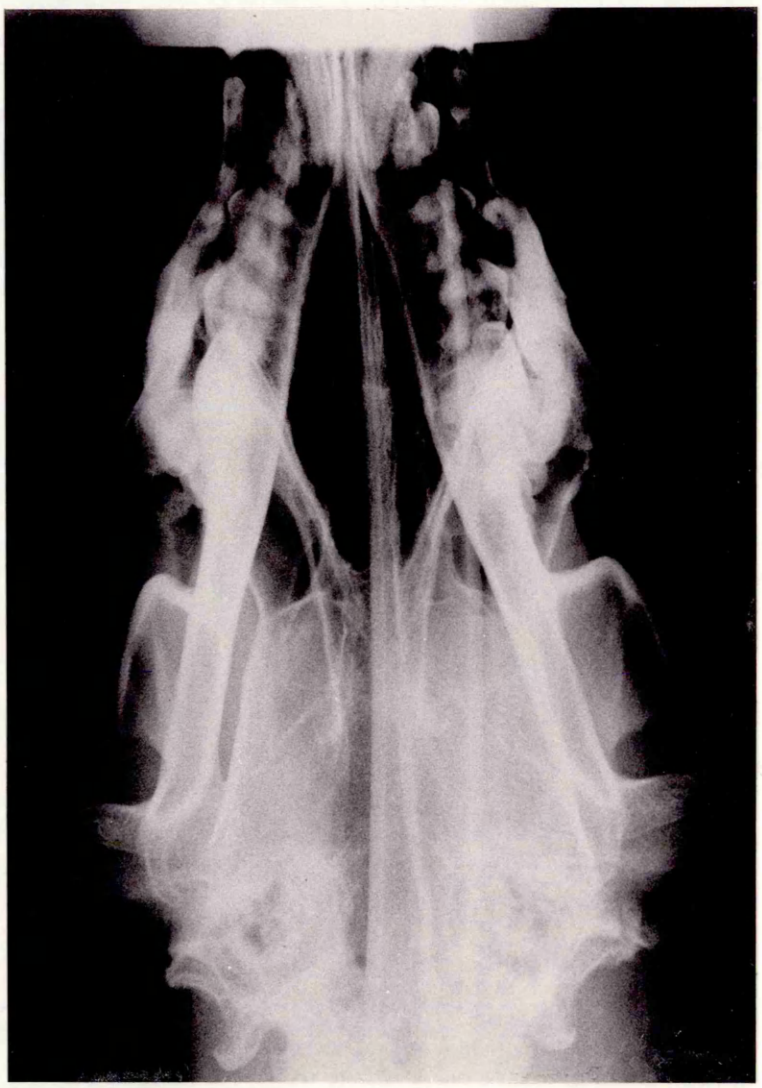

Fig. C1.2. Dorso-ventral skull. The left horizontal ear canal is mineralised and narrowed.

DISCUSSION

The indication for TECA LBO in this dog was due to the presence of end-stage otitis and failure of a previous lateral wall resection.

Lane and Little (1986), in a study of causes of surgical failure summarised the causes as incorrect patient selection for the technique performed, shortcomings of surgical technique and unrecognised and/or uncontrolled concurrent middle ear disease.

It is apparent that careful pre-operative examination and case selection is vital prior to performing a lateral wall resection. The presence of otitis media, generalised skin disorders, endocrine dysfunction and allergic diseases must be carefully considered (Berzon 1980). Pemphigus foliaceus was diagnosed in two dogs involving only the pinna and ear canals (Berzon 1980).

A thorough inspection is very difficult in a conscious animal due to severe discomfort. It is, therefore, necessary and easier to examine the animal under general anaesthesia. Examination of the ear by auroscopy can be frustrated by the presence of wax and pus, hence some authors advocate ceruminolytics and other lotions which can break up the wax (Lane 1982). Auroscopy and blunt Spreull needle can be used to evaluate the integrity of the tympanic bulla (Fraser and others 1970, Lane 1976) but with limited sensitivity and reliability. The risk of iatrogenically puncturing the ear drum with this technique has been highlighted recently (Little 1988). Matthiesen and Scavelli (1990) used auroscopy to assess the degree of stenosis or occlusion of the horizontal ear canal and to determine if TECA was necessary.

Many reports stress the use of radiography to assess the osseous tympanic bulla to allow exclusion of neoplasia (Little 1989). Skull radiographs, oblique, lateral ventro-dorsal and open mouth views, are used with open mouth giving the best results for the bulla (Douglas and others 1987). Culture and sensitivity are indicated for the treatment of secondary infections, and also in cases where otitis and otorrhoea persist in the face of rational medical or surgical treatment (Lane 1982).

In 1930, McNutt and McCoy discarded the lateral approach to the bulla because they considered it difficult to avoid the blood vessels and nerves involved. Indeed fatal haemorrhage during TECA LBO has been reported (Smeak and DeHoff 1986).

Intra-operative haemorrhage is encountered by damaging the branches of the superficial temporal artery (Bechman and others 1990). The retroglenoid vein may be damaged as it exits the retroglenoid foramen in the zygomatic process of the squamous temporal bone. Bleeding from this vessel has proved to be difficult to arrest because of its tendency to retract into the retroglenoid foramen. Severe haemorrhage has been associated with the damage to the retroglenoid vein which can be successfully arrested by use of bone wax (White and Pomeroy 1990). However,

digital pressure alone was successful in this case in arresting the haemorrhage and avoided placing excess foreign material in a potentially infected wound.

Facial nerve injury may be either temporary or permanent. It has been encountered as a common complication in ear canal ablations and bulla osteotomy (Tufvesson 1955, Berzon 1980, Smeak and DeHoff 1986, Beckman and others 1990, Matthiesen and Scavelli 1990). Manipulation of the facial nerve is inevitable during TECA due to its proximity to the horizontal canal (White and Pomeroy 1990). Meticulous blunt dissection of tissue planes close to the perichondrium should be performed to prevent injury. However, thickening of the horizontal canal due to fibrosis, bony metaplasia and abscessation that may form between the annular cartilages make dissection difficult and often prevent visualisation of the nerve (Matthiesen and Scavelli 1990). Use of conjunctiva flaps and ocular lubricants have been suggested to prevent corneal damage due to inadequate lacrimal secretion following traumatic nerve injury (Smeak and DeHoff 1986, Beckman and others 1990). But as White and Pomeroy (1990) pointed out there is continuous lacrimal gland secretion (cranial nerve VII) and passive third eyelid movement (cranial nerve VI). Hence eye protection was not given in this case.

Presence of wax, debris from mites in the external ear, pus or exudate in the middle ear, thickening of the tympanic membrane may result in conduction deafness. Diminished hearing or deafness has been encountered following TECA LBO. This form of deafness is never total, because some conduction by the bone walls of the middle and inner ear always persist (White and Pomeroy 1990).

At a second opinion centre it is exceptional to find referred cases of otitis externa which are not affected by otitis media and in many patients exposure of the horizontal canal will have already been achieved by a lateral wall resection or ablation of the vertical canal (Lane 1976).

The case reported in this paper was a good example of medical and surgical failure in the treatment of otitis in dogs because of wrong patient selection and presence of an underlying otitis media. In view of this, this dog was a good candidate for TECA LBO and the results were excellent. The owner was less concerned about the facial nerve damage than the marked improvement in the quality of the dog's life.

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Case 2

PERSISTENT RIGHT AORTIC ARCH WITH PATENT DUCTUS ARTERIOSUS IN A DOG

INTRODUCTION

Oesophageal dilatations in dogs and cats are normally the result of extramural constrictions by vascular ring anomalies, other peri-oesophageal lesions such as tumours, and disturbance of the neuromuscular control of oesophageal movements (Lawson and Pirie, 1960).

In very young puppies and kittens oesophageal dilatations are commonly due to vascular ring anomalies which are congenital anomalies of the aortic arch system.

In the normal embryological development of the brachial arches, the left fourth brachial arch persists, forming the dorsal aorta. The aorta then lies to the left of the oesophagus and the trachea and dorsal to the pulmonary artery.

The right fourth arch forms the brachiocephalic artery and the right subclavian artery. The ductus arteriosus which constricts at birth is formed from the left sixth brachial arch which in foetal life functions to by-pass the non-functioning lung from pulmonary artery to the aorta (DeHoff 1970).

By far the most common type of vascular ring seen in dogs and cats is the persistent right aortic arch (PRAA) (Lawson and others 1957, Patterson 1971, Shires and Liv 1981), and less common types include double aortic arches (Ruttman and others 1980) and anomalous subclavian arteries (McCandlish and others 1984).

Double aortic arches and subclavian artery anomalies may be asymptomatic since these do not form a complete vascular ring, though partial oesophageal compression may occur (McCandlish and others 1984). Persistent left cranial vena cava (Buchanan 1968) and patent ductus arteriosis (Patterson 1971) have been noted to occur in association with PRAA.

In PRAA, the right fourth aortic arch persists to form the dorsal aorta rather than the normal left fourth arch, resulting in a malpositioned aorta. Hence, the oesophagus becomes entrapped by the aorta on it's right, the ductus arteriosum dorsally and to the left, with the trachea and heart lying ventrally. The abnormal relationship between the great vessels and the oesophagus results in a compression of oesophagus at the heart base and the development of a pre-cardiac dilatation (Davie and Ottowa 1943, Lawson and others 1957). This results in interference with movement of ingesta because of oesophageal stenosis. Regurgitation of food, especially solids, encountered at weaning, is a consistent clinical finding in puppies and kittens. This is accompanied by poor weight gain and stunted growth compared to normal litter-mates, due to malnourishment despite a ferocious appetite (Lawson and others (1957).

The time lapse from feeding to regurgitation varies. It tends to occur within 10-15 minutes of feeding, but delayed regurgitation (> 1 hour) is reported in the older dog (Davie and Ottowa 1943, Lawson and others 1957, Berry and others 1981).

A tentative diagnosis can be made based on clinical history, signs and breed predisposition, predominantly German Shepherd dogs and Greyhounds (Buchanan 1969, Patterson 1971, Shires and Liv 1981). However, other conditions of the oesophagus with similar signs such as idiopathic megaoesophagus should be borne in mind. Plain radiographs are unreliable as they may not show fully abnormalities leading to delay in treatment. Confirmation of PRAA by barium study demonstrates an enlarged barium or food-filled pre-cardiac oesophagus (Lawson and others 1957, Buchanan 1968, Aultman and others 1980, Berry and others 1981, Shires and Liv 1981, McCandlish and others 1984).

CASE DETAILS

History

A 12-week-old German Shepherd female weighing 9.5 kg was referred to GUVH with a history of regurgitating food since weaning. At eight weeks of age, when the dog started solid feeding, the owner noticed that it was regurgitating soon after eating, but liquids were kept down. The referring veterinarian advised feeding liquidised food and increased frequency of feeding to every three to four hours. Vomiting became variable with one or two meals being retained.

Clinical Findings

The dog was very lively though thin. Palpation of the abdomen caused groaning. There was no respiratory distress, although an occasional cough was present.

Diagnostic Aid

A barium study revealed pre-cardiac oesophageal enlargement with ventral deviation of the trachea just cranial to the heart base. There was no evidence of aspiration pneumonia (Fig. C2.1).

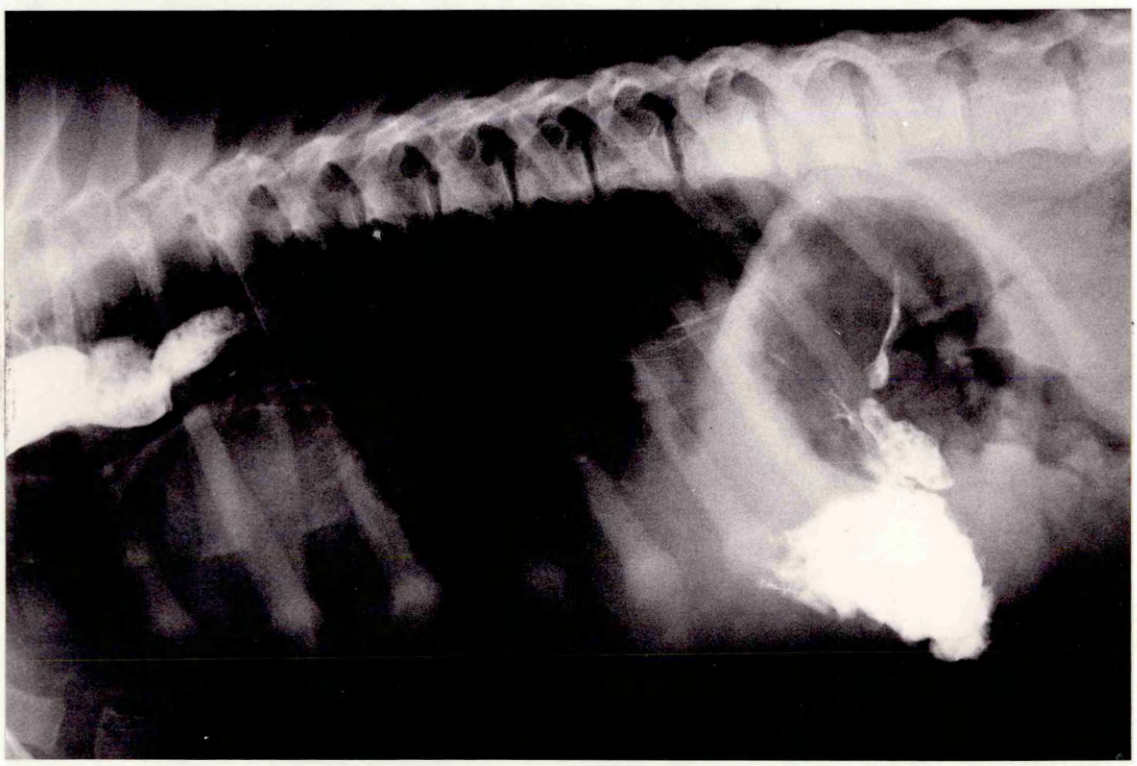

Fig. C2.1. Lateral thorax. There is dilatation of the precardiac eosophagus following a barium swallow.

Treatment

A vascular ring anomaly was diagnosed and surgical correction was indicated via fourth intercostal space (DeHoff 1970).

Routine anaesthesia was performed (Appendix 1) and a muscle relaxant was given after induction to permit greater control of ventilation and degree of muscle relaxation combined with a light plane of anaesthesia. Intermittent positive pressure ventilation at 12 breaths per minute was started soon after induction of anaesthesia. An oesophageal stethoscope was inserted to monitor heart rate. The left thorax was surgically prepared and the dog was placed in a right lateral recumbency with the forelimbs pulled slightly cranially. A heating pad was placed under the animal and the surgical site was isolated using sterile drapes. A curved skin incision was made along the fourth intercostal space after counting the ribs cranio-caudally. The incision extended from just below the vertebrae to a point above the costochondral junction. The fourth intercostal space was confirmed by counting the spaces again under the skin.

The *lattismus dorsi* muscle was divided parallel to the intercostal space and the scalenus muscle was transected perpendicular to its fibers. The *serratus ventralis* was also transected in order to expose the intercostal muscles. These were cut with a scissor close to the caudal rib to avoid the artery, vein and nerve which run near the caudal margin of the ribs. A small hole was made in the pleura using a reversed scalpel blade to allow the lungs to collapse. The incision was extended dorsally and ventrally using straight Mayo scissors. Moist swabs were packed along the incision and self retaining retractors were inserted. The cardiac lung lobe was reflected caudally and packed gently with moist swabs. The bulge of the oesophagus and base of the heart were identified. The mediastinum above the heart base was opened. This exposed a white pulsating cord lateral and dorsal to the oesophagus, connecting the aorta to the pulmonary artery and causing a stricture of the oesophagus at the heart base. A pair of Denis Browne ductus arteriosus dissecting forceps were used to dissect free the cord from adjacent soft tissue. Once the cord was freed from the medial side two haemostats were placed on the ductus close to the aorta and main pulmonary artery respectively.

As the clamps were gently released "0" silk ligatures were tightened on the aortic and pulmonary sides. The ligatures were left long to allow easy retrieval of the stumps in case of bleeding. The ductus was then transected between the ligatures and the stumps checked for haemorrhage. A lumen was present on both stumps showing that the ligament was in fact patent (Fig. C2.2). The connective tissue around the oesophagus was dissected to free the oesophagus. The oesophagus was seen to bulge at the stricture site as more connective tissue was loosened.

Closure of the thoracotomy was done by pre-placing polydioxanone (PDS) "0" sutures around ribs 4 and 5. The ribs were approximated using towel clamps and the sutures were tied. Muscle layers were closed layer by layer with 2-0 vicryl. The subcutaneous tissues were apposed using 2-0 vicryl, and the skin with a simple interrupted suture pattern with 2-0 nylon. About 100 mls of air was drained from the chest with a 16g longdwell catheter attached to a three-way tap and syringe. IPPV was continued until voluntary breathing resumed. Recovery was uneventful.

Follow-up

A pain-killer (papaveretum) was given immediately post-operatively as is indicated for thoracotomies. The dog was bright the following day. On the third day she was fed some gruel food without regurgitating. The dog was discharged and the owner was advised to continue feeding liquidised food every four hours from a height.

The dog was re-examined five weeks post-operatively. The owner reported that she was unable to feed the dog from a height because the dog was not co-operative. Regurgitation continued for a week post-operatively after which there had been no more regurgitating. At this time the dog was being fed twice daily and had gained 6kg. A barium study was done eight weeks post-operatively and although the oesophagus was dilated it looked relatively smaller in relation to the dog's size. Regurgitation was not reported.

DISCUSSION

The dog presented in this report is an example of a vascular ring anomaly with a typical breed, history, clinical and radiographic picture (Coward 1957, Buchanan 1968, Funkquist 1970, Patterson 1971, Shires and Liv 1981).

PRAA may occur in combination with other cardiovascular diseases. Patterson (1978) noted that 13 of 290 dogs with cardiovascular disease had persistent cranial vena cava, with 10 out of the 13 having PRAA. Recognition of persistent cranial vena cava is important during surgery of PRAA. PRAA with patent ductus arteriosus is a less common finding (Buchanan 1968).

In PRAA no abnormalities are detected on auscultation, in haemodynamics or electrocardiogram unless there is a co-existing PDA (Buchanan 1968). In the dog reported here no murmurs were heard despite the presence of a PDA. This has been attributed to the small size of the PDA (Patterson 1968).

Diagnosis of PRAA is made easy by barium study coupled with history and clinical findings. Plain radiographs may be misleading. A 3 month-old Greyhound had no abnormalities on plain radiographs, yet PRAA was confirmed at post-mortem (Davie and others 1948). Plain films of two cats with megaoesophagus showed no abnormalities (Berry and others 1981, McCandlish and others 1984).

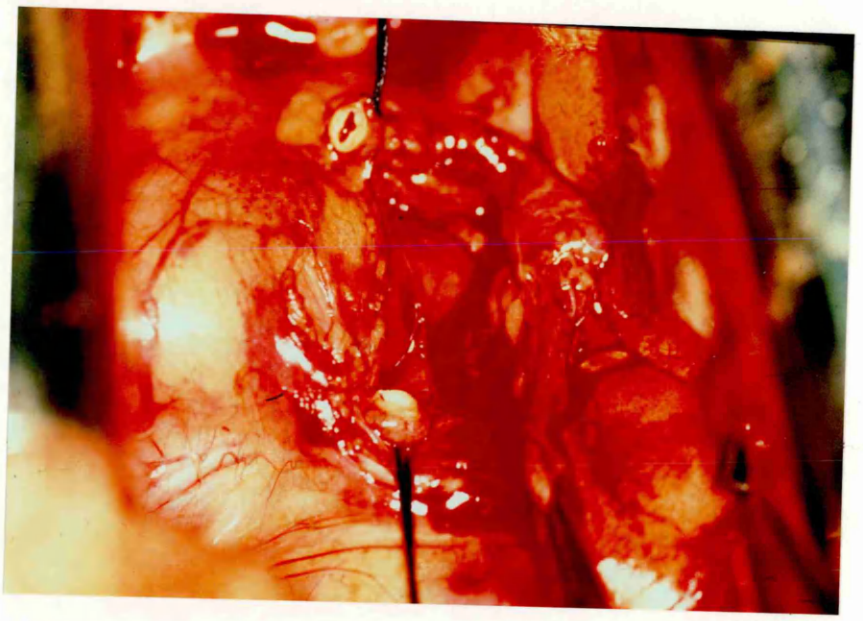

Fig. C2.2. Thoracotomy. The ductus has been ligated and sectioned, note the patent lumen. The bulging oesophagus can be seen proximal to the sectioned ductus.

DeHoff (1970) emphasised early surgical treatment of PRAA before complications (oesophagitis, thinning of the wall) become pronounced. Persistent dilatation of the oesophagus will result in permanent loss of elasticity due to the destruction of nerve endings, with thinning of the wall of the dilated segment (Imhoff and Forster 1963). Regurgitation of food is stimulated by this dilatation which may result in inhalation of food particles causing aspiration pneumonia. Many patients are able to keep fluids down. However, fluids will be regurgitated in longer standing cases. All these factors result in an animal that is thin, stunted and dehydrated due to malnutrition with respiratory disease.

Depending on the severity of the condition, the oesophagus may remain dilated even after surgical correction and regurgitation will persist. Thus some animals will require postural feeding for varying lengths of time (Imhoff and others 1963, Funkquist 1970, Shires and Liv 1981). This was not possible in this case because of the uncooperative nature of the dog.

The outcome of surgical correction is dependent on a number of factors. Compromised cardiac output and alveolar ventilation are of great importance and concern to the anaesthetist. Shires and others (1981) in their survey of post surgical survival, found out that the survival rate was high soon after surgery. However, in the long term follow up the death rate was high. Some authors recommend delaying surgery and attempting to improve the condition of the animal through oesophageal by-pass procedures. It is argued that these procedures are just as traumatic as the correction of the vascular defect (DeHoff 1975).

The megaoesophagus which persists post-operatively and which is the cause of continued regurgitation may be corrected by imbrication or oesophagoplasty at the time of surgery, or at a later date when the animal has achieved a desired level of strength (DeHoff 1975, Funkquist 1970). These procedures are not without complications. Funkquist (1970) carried out successful oesophagoplasty in two out of three dogs. One died of suture breakdown and exudation of oesophageal contents into the thoracic cavity. There has been no large series published to establish the value of this technique.

Vascular ring anomalies causing megaoesophagus and uncomplicated patent ductus arteriosus must be treated as soon as possible after diagnosis, before secondary changes take place. This will give good results (weight gain, no more regurgitation) reduce aftercare and mortality. The dog presented here was treated at the correct time and the results at five weeks and two months later were encouraging.

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Case 3

TOPICAL ENILCONAZOLE IN THE TREATMENT OF NASAL ASPERGILLOSIS IN A DOG

INTRODUCTION

The nasal cavity is encased by the nasal septum medially, cribriform plate caudally, hard palate ventrally, maxilla, frontal and lacrimal bones dorsally and laterally. Within the nasal cavity are the delicate scrolls of compactly arranged turbinate bones. Thickening and/or infection of the turbinates, or irritation by foreign bodies can interfere with normal air flow causing sneezing and/or production of mucus from the secretory lining. Neoplasia, mycotic rhinitis, chronic rhinitis and foreign bodies are some of the intranasal conditions commonly encountered in dogs and cats which will give rise to these signs (Delmage 1973).

Fungi are a heterogeneous group of organisms ranging from unicellular bodies such as Cryptococcus to the mycelium forming types such as Aspergillus. *Aspergillus* species are ubiquitous saprophytes found growing in stables and vegetation, with spores present in dust, hay and straw (Barrett 1988). Even though the genus aspergillus comprises a number of species, only a few have been reported to cause diseases in humans, cattle, horses, birds, dogs, cats and other mammals. These include *A. fumigatus* (the most pathogenic), *A. nidulans, A. niger, A. flavus* and *A. terreus*.

The respiratory system is the commonest site of infection and the majority of reports have shown these infections to be caused by *A. fumigatus* (Dawson and others 1973, Black and Nightingale 1973, Barret and others 1977, Hargis and others 1986, Sharp and Sullivan 1986).

In general, canine aspergillosis presents as a nasal and frontal sinus infection (Black and Nightingale 1973, Lane and others 1974, Sharp and Sullivan 1986, Sullivan and others 1986). However, Wood and others (1978) and Mullaney and others (1983) reported uncommon cases of disseminated aspergillosis caused by *A. terreus*, solely affecting German Shepherds without an apparent involvement of the respiratory system

Immuno-suppression due to neutropenia, loss of normal microbial clearance (Barsanti 1984), prolonged corticosteroid therapy (Fox and others) appear to be involved in the pathogenesis of aspergillosis. The large number of spores found in the environment, particularly the high concentration in hay and straw, is the source of infection in healthy dogs (Black and Nightingale 1973), while local trauma or foreign bodies may precipitate aspergillosis (Hargis and others 1985). It has been observed that opportunistic fungal infection occurs more frequently in dolicocephalic and mesaticephalic breeds, suggesting a genetic or anatomical predisposition (Barret and others 1977).

Canine aspergillosis is most often a chronic rhinitis with unilateral or bilateral nasal discharge (Black and Nightingale 1973, Barret and others 1977, Sharp and Sullivan 1986). It may initially respond to antibiotic therapy, possibly due to secondary bacterial infection (Black and Nightingale 1973, Barret and others 1977, Hargis and others 1986).

Both medical and surgical approaches to the treatment of canine and feline aspergillosis have been attempted. No one therapy has been totally effective, but some have more merit than others. A combination of both antibiotics, corticosteroids with thiabendazole, local nystatin and systemic amphotericin with trephination failed to resolve aspergillosis infection in a dog (Black and Nightingale 1973), while a Boxer was treated successfully using tetracycline and nystatin for two months (Chandler 1975). Lane and others (1974) treated four cases of canine nasal aspergillosis successfully by radical surgery and curettage with topical infusion of nystatin followed by dilute iodine solution. Antifungal therapy with 5-fluorocytocin and sodium iodine *per os* with nasal curettage and flushing with iodide was successful in two dogs (Barret and others 1977).

Harvey (1984), reviewing 47 cases, found in 57% treatment with thiabendazole failed. Forty seven percent of 15 dogs with nasal aspergillosis responded to treatment with ketaconazole at a low rate of 10mg/kg. The conclusion was that ketaconazole was no more effective than thiabendazole (Sharp and Sullivan 1989).

Recently, a new drug enilconazole, alone or in combination with systemic ketaconazole has been reported to give very encouraging results when used topically (Sharp and Sullivan, 1986). The technique of tube implantation is the one described by Sharp (1989).

Since intranasal and frontal sinus lesions may be any of the following: neoplasia, mycotic infection, foreign body or chronic rhinitis (Delmage 1973), an exhaustive clinical examination has to be done and must be supplemented by radiography, rhinoscopy, smear, culture, serology and histopathology.

CASE DETAILS

A four-year-old Border Collie was presented to GUVH with a three month history of bilateral nasal discharge. Three months previously, the dog was treated with antibiotics for nasal discharge without any improvement. Indeed at presentation the owner reported a worsening of the condition.

Clinical Findings

There was haemorrhagic and mucopurulent discharge from the right and left nostrils respectively. The dog showed signs of pain and ulceration of the rhinarium. On the second day of hospitalisation, there was a bilateral haemorrhagic nasal discharge (Fig. C3.1).

Diagnostic Aids

Radiography

A dorso-ventral intra-oral view revealed bilateral turbinate destruction with an increase in radiolucency. The rostro-caudal view of the frontal sinus demonstrated thickening and opacification of the sinuses with a depression of the left frontal bone. This depression was palpable with the dog under anaesthesia (Figs. C3.2, C3.3).

Culture

A sample showed moderate growth of *Aspergillus fumigatus*.

Rhinoscopy

It was not possible to see any fungal colonies in the nasal cavity because of blood accumulation.

Serology

Serum was positive for aspergillus antibody with a titre of 1:4.

Fig. C3.1. Nose. There is copius bilateral haemorrhagic nasal discharge and the sill of the left rhinarium is ulcerated .

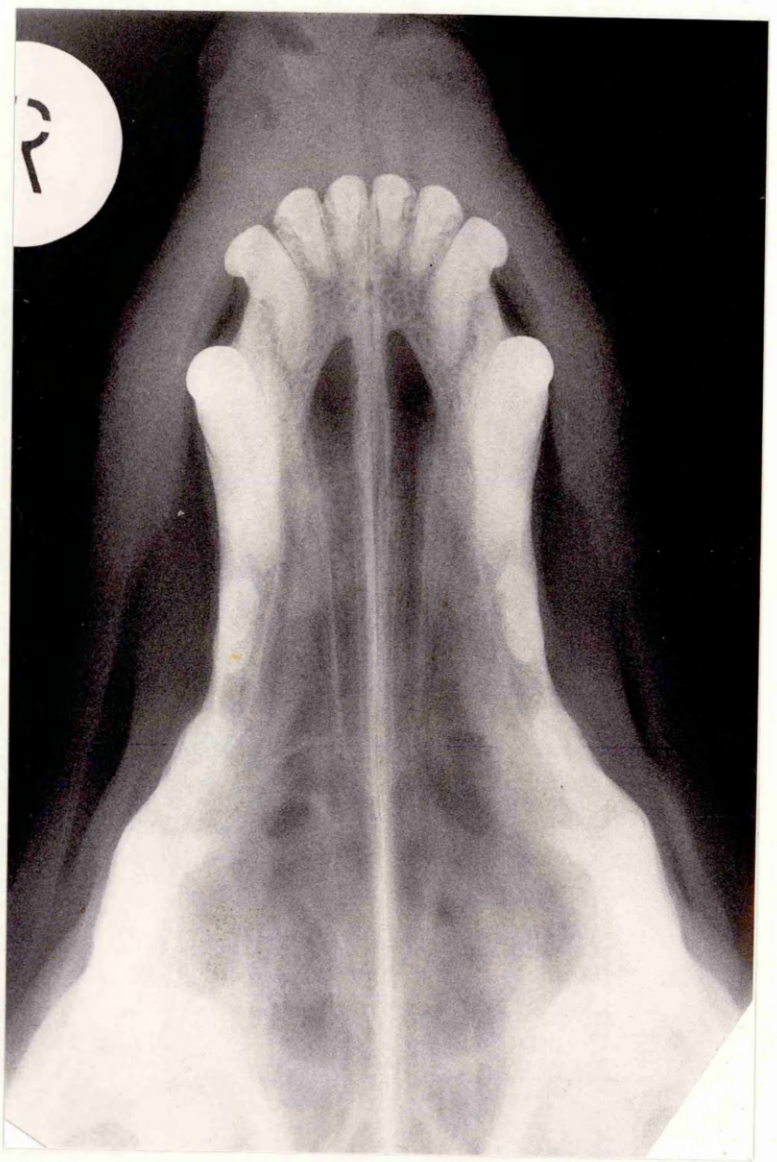

Fig. C3.2. Dorso-ventral intra oral view of nasal cavity. This view demonstrates bilateral nasal turbinate destruction with areas of increased radiolucency.

Fig. C3.3. Rostro-caudal view of frontal sinus. There is a depression fracture of the left frontal bone with thickening and opacification of the sinus. Fungal colonies were seen in both sinuses at surgery.

Treatment

A diagnosis of nasal aspergillosis was made in this case on the basis of the radiological and serological findings.

Routine anaesthesia (Appendix 1) and surgical preparation of the areas around the frontal sinuses was done. The dog was placed in sternal recumbency with the head supported by a sandbag and draped.

A 1.5cm skin incision was made above the left frontal sinus. The muscle layers were separated and the periostium was cut and lifted from the frontal bone. A defect was found in the frontal bone suggesting previous trauma to the frontal bone. Fibrous tissue covering the defect was cut. Fungal balls were found in the sinus and were removed. Intravenous drip tubes were inserted, one into the nasal cavity as far as the carnassial tooth, the other into the frontal sinus. A similar approach was made on the right side. The frontal bone was intact on this side and a hole was trephined and enlarged with bone rongeurs. More fungal balls were found in the sinus and removed. Tubes were implanted as *per* the left side. The skin incisions were partially closed with two nylon sutures. The tubes were secured with zinc oxide butterfly tapes and sutured to the skin. The tubes were labelled for identification purposes (Fig. C3.4.).

Flushing with 10mg/kg enilconazole twice daily was started 24 hours after tube implantation. The dog weighed 17kg and the calculated dose was 1.7 ml enilconazole. With the dog's head lowered, each tube was flushed with the enilconazole diluted with normal saline to make a 5ml solution. This was immediately followed by flushing 20ml of air into each tube to evacuate the solution from the tubes. The dog was in pain and very uncomfortable. Flushing was done twice daily for 7 days. By the third day, the dog was tolerating the procedure and by the fifth day the dog was looking brighter with less haemorrhage. During this time the dog was not eating and developed diarrhoea. The dog was discharged after completion of the 7 days flushing. The nasal discharge had greatly decreased.

The dog was re-examined a month later. The owner reported that the dog was much brighter and more active, despite the fact that the discharge had not completely stopped. The owner complained that the dog made wheezing sounds from its nose. On examination there were dry crusts on the nostrils. The discharge from the left nostril appeared to be slightly blood tinged. The dog was re-admitted and dorso-ventral intra-oral and rostro-caudal frontal sinus radiographs were repeated. There was opacification of the frontal sinuses only.

A second flushing for 7 days was done as before. Culture sample showed light growth of aspergillus. The serology test was still positive for *A. fumigatus*.

The owner of the dog was contacted four months later by telephone, he reported that the dog still had discharge with the wheezing sound.

Although the dog was slightly better, this treatment is considered to be a failure especially after two treatments. The owner was also reluctant to have further surgery and opted for a course of oral ketoconazole for six weeks. At the end of this treatment the owner was contacted and he reported that the dog had greatly improved. There was no sign of pain and the dog had put on weight. A slight nasal discharge was still present but was acceptable to the owner.

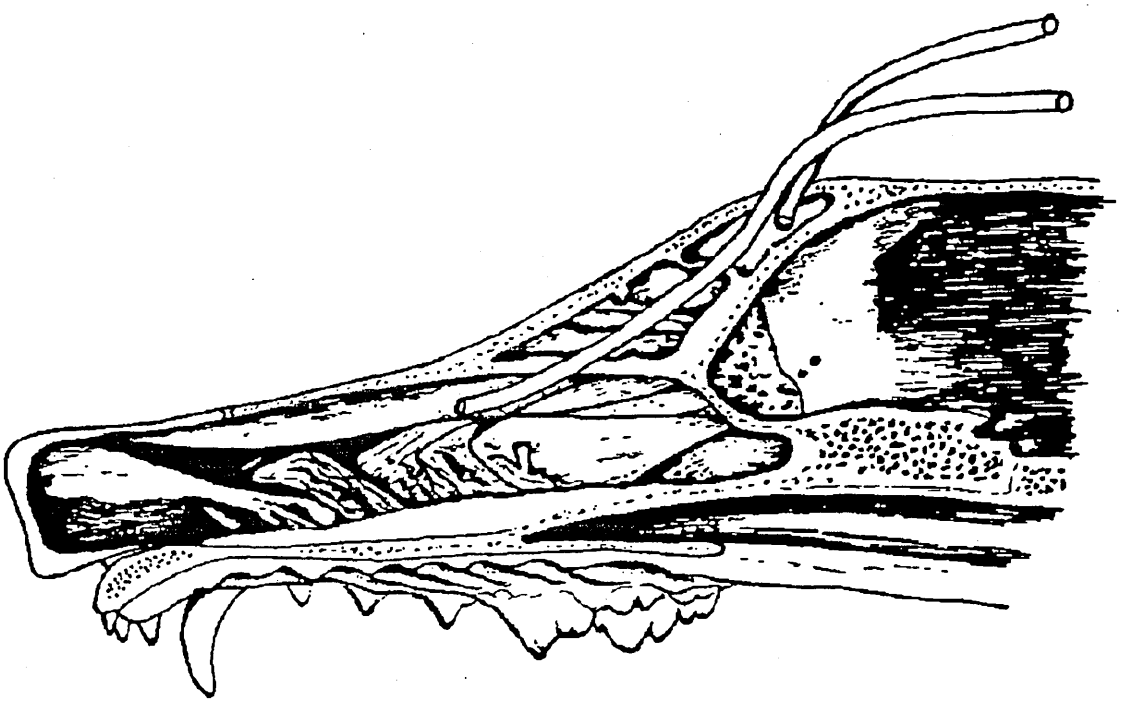

Fig. C3.4. Drain implantation.

DISCUSSION

This case is an example of canine nasal aspergillosis with trauma of the frontal sinus as a likely predisposing factor. Not many reports have been able to pin-point a predisposing factor in cases of nasal aspergillosis in the dog. In one report, two cases of direct trauma to the nose preceded the onset of clinical signs of aspergillosis (Lane and others 1974).

It is debatable whether immuno-suppression which has been found concurrently with aspergillosis, is present prior to infection or is caused by the infection. Support for the concept of immuno-suppression or immuno-incompetence comes from the few published cases of feline aspergillosis where most had panleukopenia or leukaemia virus (Fox and others 1978, Goodall and others 1984).

In general, nasal conditions present with a uni- or bilateral discharge (which may either be haemorrhagic, mucoid or purulent) sneezing, snoring with or without facial swelling and pain. In nasal aspergillosis, the common findings include a sanguinopurulent discharge and epistaxis (Black and Nightingale 1973, Lane and others 1974, Hargis and others 1986, Sharp and Sullivan 1986). Ulceration of the rhinarium due to continuous licking, and facial pain have been reported as differentiating features (Sharp and Sullivan 1986). Both were present in this case.

The most useful and reliable aids to diagnosis are radiography and serology. The use of radiography is well established and quality films can substantiate a diagnosis. The most utilised views are the dorso-ventral intra-oral and the rostro-caudal frontal sinus views. The customary findings in nasal aspergillosis are increased radiolucency with loss of turbinate pattern (Lane and others 1974, Gibbs and others 1979, Sullivan and others 1986). An increase in radiodensity of the nasal cavity without turbinate destruction was reported in a dog with non-invasive nasal aspergillosis (Hargis and others 1986). Thus caution should always be exercised in interpreting radiographs of the nasal cavity, and early lesions usually have similar radiographic changes, hence the importance of good exposure technique, patient positioning and film developing.

The rostro-caudal frontal sinus view reveals opacification, thickening and mottling of the sinus (Sullivan and others 1986). The importance of this view is related to the identification of frontal sinus involvement and the consequent necessity to terminate a drain in the sinus for flushing with enilconazole.

Smears and cultures are unreliable (Chandler 1975). Direct smears and cultures gave positive results in only six of 10 cases (Lane and Warnock, 1977). However, most papers on clinical nasal aspergillosis highlight the consistency of serology as a diagnostic aid. Counter-immunoelectrophoresis (CIE) and agar-gel double diffusion (AGDD) tests are methods of detecting microbial antigens and have been found to be reliable in the diagnosis of canine aspergillosis. The advantage of CIE is the rapidity with which results are obtained (Richardson and others 1982).

Agar-gel double diffusion test carried out in 10 dogs gave 100% diagnosis of *A. fumigatus* without any false positives in the control group. A seropositive result has also been obtained from a cat with aspergillosis (Goodall and others 1984). The titre of 1:4 was a positive indication of the presence of aspergillosis. The fact that the titre had not fallen by the first follow-up does not necessarily indicate continued infection, since the titre takes some time to fall even in animals which are cured (Sharp and others 1983).

Rhinoscopy can be frustrated by the presence of copious discharge as was the problem in this dog. Nevertheless, it is a useful quick diagnostic aid in those cases with fungal colonies in the nasal cavity (Sullivan 1987).

Side-effects of enilconazole: salivation, sneezing, inappetence and gastrointestinal upset (Sharp and others, 1983) were noted in this case due to nasal and gastric mucosal irritation. The tubes may also cause sneezing by irritating the nasal mucosa. However, they were tolerated after a number of flushings. The head position during flushing prevents aspiration of the fluid.

Toxic effects from other drugs used in the treatment of aspergillosis have been reported to be more serious and not easy to control (Black and Nightingale 1973, Barret and others 1977, Sharp and Sullivan 1989),

The failure of enilconazole after two treatments is disappointing and at odds with the usual response to treatment at GUVH. A great improvement in the dog's condition was reported at the termination of the six weeks oral ketoconazole course though a slight crusty discharge has persisted. Slight discharge may persist after treatment due to bacterial rhinitis in an altered microclimate (Sharp and others 1983). However, despite the optimistic report from the owner it is not possible to say whether ketoconazole has been effective in this case without rhinoscopic follow-up. The fact that there was a good response to ketoconazole suggests that there was marked invasion of the periorbital tissues.

There are very few reports on the use of enilconazole in the treatment of aspergillosis in dogs. Therefore, there is limited data to suggest which candidates are suitable for treatment with enilconazole.

The case presented had severe involvement of the frontal sinus with evidence of frontal bone fracture. The failure of topical treatment could be attributed to the fracture permitting a more extensive invasion of bone than is usual.

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Case 4

NASOPHARYNGEAL POLYPS IN THE CAT: TREATMENT

INTRODUCTION

Polyps represent a most important differential diagnosis in feline upper respiratory tract (URT) diseases which include; feline rhinotracheitis (FVR), feline calicivirus infection, mycosis, neoplasia, chronic rhinitis and sinusitis. Nasal discharge and sneezing are common findings in URT diseases in young susceptible cats

Polyps have been found in the nasopharynx, eustachian tube, tympanic bullae and external ear canal of young cats less than three years of age (Harvey and Goldschmidt 1978, Bedford and others 1981, Lane and others 1981,). In older cats polyps frequently present as a chronic nasal or ear infection (Lane and others 1981).

The actual cause of the polyps is not known, though it is generally agreed that they arise from the middle ear due to chronic infection and follow the route of least resistance. The growth reaches the nasopharynx via the eustachian tube, and the external ear canal via the tympanum. (Harvey and Goldschmidt 1978, Lane and others 1981). This, however, was refuted by Bedford and others (1981) when they failed to find evidence of bulla involvement in three cases out of four. In each cat the polyp was attached to the opening of the eustachian tube by a stalk and the authors suggested that the polyps could have originated from the eustachian lining. However, the histopathological findings seem to support both ideas.

In general, nasopharyngeal polyps present as upper respiratory tract infections, nasal discharge, dyspnoea and/or otitis which is manifested by otorrhoea, head shaking and tilting (Harvey and Goldschmidt 1978). There is no interference with swallowing in most of these cases. Lane and others (1981) reported a cat which had difficulties swallowing and resented having it's mouth opened.

It is generally agreed that these polyps are inflammatory growths and can be differentiated clinically from neoplasms due to their characteristic appearance, from the history and also due to the rarity of feline ear and nasal neoplasms (Harvey and Goldschmidt 1981). Physical examination of oral cavity and external ear coupled with radiography of the skull and bullae will confirm the diagnosis.

Management of these polyps depends on the site at time of examination. In a report by Bradley and others (1985), three cats out of five that had ventral bullae osteotomies did not show any evidence of regrowth 13 months post-surgery. Ventral bullae osteotomies in cats showing evidence of bullae involvement radiographically had a high success rate in 28 cats, with only one cat developing a regrowth (Kapatkin and others 1990). Chances of regrowth seem to be higher in cats that undergo a lateral wall resection with or without splitting of the soft palate (Harvey and Goldschmidt 1978, Bradley and others 1985, Kapatkin and others 1990).

Two cats with nasopharyngeal polyp and external ear polyp are presented. Radiography and physical examination was used to determine the surgical approach.

CASE DETAIL

Case 1

History

A two-year-old neutered female domestic short haired cat was referred to GUVH with a history of sneezing, choking and bringing up food since 3 months of age. The owner obtained the cat from the Cat and Dog Home a month before these signs were seen, though she reported that the cat had a slight nasal wheeze since she had obtained it.

Treatment with broad spectrum antibiotics brought about some improvement. However, a few weeks later the cat was taken to the veterinarian because of choking and difficulty in breathing. Again it was treated with antibiotics and anti-inflammatory drugs which seemed to work initially. The owner was also advised to feed sloppy food and this was being retained.

Clinical Findings

The cat was very thin with an unkempt hair coat. She was sneezing, had a slight nasal discharge with signs of respiratory obstruction. Oral examination under general anaesthesia revealed a pink granular growth protruding just caudal to the soft palate, displacing the palate ventrally.

Diagnostic Aids

Lateral skull and open mouth rostral caudal radiographs were taken. These revealed a soft tissue opacity dorsal to the oropharynx. There was no evidence of bullae involvement.

Treatment

Routine anaesthesia was used (Appendix 1). Pethidine was given as an analgesic. The cat was placed in sternal recumbency and the head was held slightly up. The soft palate was drawn forward with a spey hook. This allowed good exposure of the mass which was arising from the right side of the palate. A small artery forceps was used to grasp the mass and to gently pull it forward. A second pair of forceps was applied further down the stalk and the mass was avulsed from its attachment (Fig. C4.1). Some bleeding was encountered at this point. This was controlled by packing the pharynx with a swab. When the swab was removed two minutes later there was no more bleeding. The patient made an uneventful recovery from anaesthesia.

Follow-up

The following day post-surgery, the breathing had markedly improved. There were signs of mild Horner's syndrome (miosis and third eyelid prolapse) in the right eye. Horner's syndrome was still present on the third day. The cat was re-examined four weeks later. The dyspnoea and nasal discharge had cleared. The coat had greatly improved and cat had gained weight. Horner's syndrome was, however, still present and the cat had lost some of its voice. There was no evidence of regrowth when the nasopharynx and eustachian tube ostia were examined.

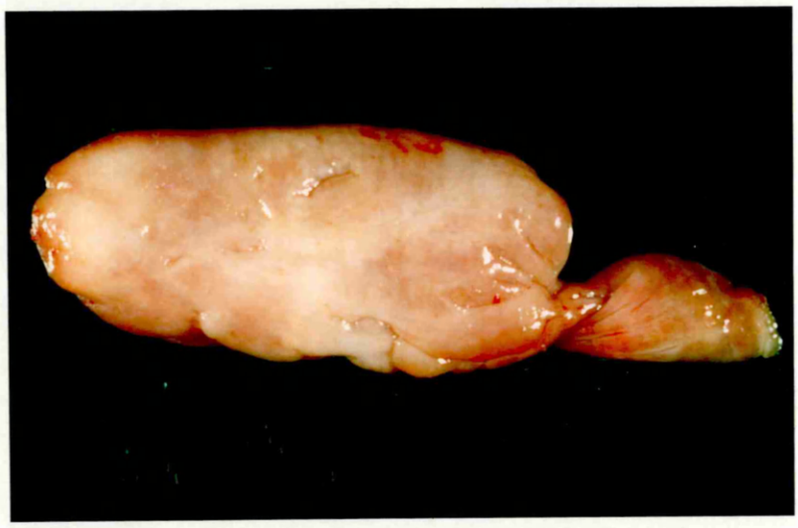

Fig. C4.1. Nasopharyngeal polyp. This polyp was removed by traction. Note the distinct demarcation between the main body and the stalk.

Case 2

History

A one-year-old male neutered Siamese cat was presented to GUVH with a history of chronic right ear discharge since it was a kitten. It was presented to the referring veterinarian with right ear discharge. The cat was treated with systemic antibiotics and ear drops. There was a modicum of improvement, but some five months later the condition relapsed and since then had been worse with severe purulent discharge, head shaking, tilting and scratching. It had no problems with swallowing, but occasional sneezing and nasal discharge.

Clinical Findings.

The cat was extremely bad tempered. Acetylpromazine was used to sedate it. Dried discharge filled the ear canal and auroscopy revealed a pink mass in the external ear canal partially covered by pus. No growth was seen in the oral cavity.

Treatment

A polypoid growth was diagnosed involving the right tympanic bullae and the ear canal. Total ear canal ablation and lateral bullae osteotomy (TECA LBO) was indicated. The cat was premedicated using xylazine and atropine, the rest of the anaesthetic technique was routine (Appendix 1) The left ear was clipped and prepared for aseptic surgery.

The cat was placed in a left lateral recumbency with a sand bag to support the neck. The surgical site was isolated with sterile drapes. A T-shaped skin incision was made over the vertical canal. Another skin incision was made on the medial side of the pinna to complete the incision round the external canal. The whole ear canal was exposed medially and laterally by dissecting round it, keeping very close to the pericondrium. The horizontal ear canal was resected at the external acoustic meatus and with it part of the polyp was removed. Small ronguers were used to open into the bulla. The remaining polyp was removed with artery forceps. The bullae was gently curetted and flushed with saline. Great care was taken to avoid injury to the thin shelf of bone in the bulla. The subcutaneous tissues were apposed using 3-0 vicryl, and the skin was closed in a T shape with 3-0 nylon. Analgesic was given immediately post-operatively.

Follow-up

Recovery from anaesthesia was uneventful. Post-operatively, the cat developed Horner's syndrome on the right eye.

DISCUSSION

Signs related to otitis (otorrhoea, head shaking and tilting) and upper respiratory tract infections have been seen in cats with aural and nasopharyngeal polyps.

Physical examination of a conscious cat can present problems as was seen in case 2. General anaesthesia is recommended but great care should be taken due to the respiratory obstruction which already exists in cats with nasopharyngeal masses. Physical examination will reveal a mass in the nasopharynx displacing the soft palate ventrally (Carpenter 1971, Harvey and Goldschmidt 1978, Lane and others 1981), or in the external ear canal (Harvey and Goldschmidt 1978), as was seen in both cases.

Lateral skull radiographs to demonstrate nasopharyngeal masses and either ventro-dorsal skull or open mouth views for tympanic bullae evaluation are indicated when polyps are suspected (Bedford and others 1981, Lane and others 1981, Bradley and others 1985, Kapatkin and other 1990).

The choice of surgical methods used in cases 1 and 2 depended on the site of the polyp at radiography. TECA LBO was performed in case 2 due to bullae involvement. Kapatkin and others (1990) are of the opinion that ventral bullae osteotomies should be carried out in all cases showing bullae involvement radiographically. The changes in the bullae are demonstrated as an increase in radiopacity.

Temporary Horner's syndrome is a common sequel to bullae osteotomy. This complication occurred in 81 percent of 23 cats which underwent ventral bulla osteotomy. The prognosis for these cats was very good and only one had a regrowth of the polyp (Kapatkin and others 1990). Damage is caused by disturbance of the post-ganglionic sympathetic axons which pass through the middle ear enroute to the eye and eyelids. However Horner's syndrome may persist in some cases (Lane and others 1981). Horner's syndrome developed in this case post-operatively.

Simple traction of the polyp is indicated in cases where the polyp is situated in the nasopharynx and in many cases it is visible orally displacing the soft palate. Splitting the palate may be required for good exposure in some cases (O'Brien and Harvey 1983). The aim is to detach the stalk of the polyp at its point of origin making sure that no polypoid tissue remains attached, as this will result in a regrowth. Traction alone was 100% successful in four cats (Bedford and others 1981). However, regrowth of polyps seems to be more frequent where traction alone has been done (Bradley and others 1985, Lane and others 1981, Kapatkin and others 1990). Regrowth of the polyp may take from days to years after surgery. In some cases regrowth has occurred more than twice (Lane and others 1981) because each time the polyp is removed some polypoid tissue is left behind and regrows.

In case 2, TECA LBO was chosen because of the presence of the polyp in the external ear canal and bulla involvement. Ventral bulla osteotomy has been recommended as it provides good exposure and affords opening of the septum which separates the dorso-medial and ventro-lateral compartments of the tympanic cavity in cats for tissue removal (Ader and Boothe 1979, Bradley and others 1985). This approach also exposes the external ear canal. In this cat the mass was visible in the external ear canal and extended into the tympanic bulla. TECA LBO in addition to providing good exposure to the tympanic bulla, makes it easier to remove masses which have traversed the tympanic membrane into the external ear canal. Bulla osteotomy should always be considered when there is bullae involvement radiographically. Some authors even recommend bulla osteotomy on the side from which the polyp originates if this can be determined even if there are no radiographic changes in the bulla itself (Kapatkin and others 1990).

Histological findings of mucous glands in the granulation tissue of the polyp indicate a site of origin close to the eustachian tube orifice in the middle ear (Pearson and Hart 1980, Lane and others 1981). The histological findings of the two polyps showed masses lined with stratified squamous epithelium and pseudostratified columnar ciliated epithelium, beneath was an infiltration of plasma cells, lymphocytes and some neutrophils. These findings together with those reported elsewhere (Pearson and Hart 1980, Lane and others 1981) are consistent in supporting the contention that the origin of these polyps is in the middle ear or eustachian tube, although the exact point of origin cannot be determined due to the fact that the pseudostratified columnar epithelium of the nasopharynx, auditory canal and tympanic bulla is continuous (Bradley and others 1985).

Horner's syndrome in case 2 was due to damage of the postganglionic axons during curettage. However, the same condition was noticed in case 1 in which only traction was used to remove the polyp and there was some loss of voice which could have been due to some damage in the larynx during intubation.

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Case 5
ACQUIRED CLEFT PALATE IN A CAT

INTRODUCTION

Cleft palate may be regarded as a congenital or acquired complete separation of the lateral palatine process with fusion of the oral and nasal cavities (Mosier 1979). This defect results from failure of the embryonic tissue to grow and fuse together in the midline and it may be accompanied by malformations of other systems (Noden 1986). Teratogens, stress and drugs are thought to be likely causal factors.

Acquired cleft palate results from severe periodontal disease or tooth extractions, electric burns, dog bites, road traffic accidents and in cats falling from a height (Lane 1982, Harvey 1985).

Congenital palatine defects (primary and secondary) have been reported more frequently in dogs (Hobson and Heller 1971, Howard and others 1974). The defect is said to be rare in all breeds of cats except the Siamese, in which there is evidence of an inherited predisposition (Lane 1982, Noden 1986). Nasal discharge, rhinitis, sneezing and nasal regurgitation of food soon after eating are common clinical signs Diagnosis is straightforward on oral examination, unless the defect is very small (Lane 1982, Wardrip 1982).

Surgery is the only method of treatment. Success depends on size and position of the defect. Various techniques (overlapping, sliding, prosthesis) are used singly, or in combination to try to create a seal between the oral and nasal cavities. Multiple surgeries may be required to correct a defect (Thoday 1975, Wardrip 1982).

Because of difficulties encountered in repairing cleft palate and also the risk of surgery and anaesthesia, puppies and kittens are often euthanased, particularly by breeders. It is recommended that surgery be done at least at the age of twelve to fourteen weeks (Lane 1982), though it can also be carried out successfully as early as seven weeks (Howard and others 1974).

An acquired cleft of the hard and soft palate in a cat is presented in this report.

CASE DETAIL

History

A four-month-old male domestic short hair cat (2kg) was presented to GUVH with a history of having been attacked by a dog eight weeks previously. The cat sustained fractures of the facial bones and displacement of the left mandibular ramus. Conservative treatment was successful and the cat was eating and drinking normally. Five weeks later, the cat was taken back to the referring veterinarian with bilateral nasal discharge and sneezing, especially after eating or drinking. An infected palatine defect was found on oral examination. Antibiotics were prescribed for seven days and the cat was referred to GUVH. Although there was some improvement during the antibiotic

course, the discharge had become purulent, and the cat was snoring during sleep and still sneezing.

Clinical Examination

An oval defect involving the hard palate was found near the junction with the soft palate, measuring about 7mm at its widest diameter (Fig. C5.1). It did not seem infected, although nasal discharge was still present.

Diagnostic Aids

No abnormalities were seen in the chest radiograph. Radiography of the skull revealed healed fracture lines of the facial bones.

Treatment

Surgical repair of the defect was done using the "sandwich" technique. Routine premedication, induction and maintenance were used (Appendix 1). The cat was placed in dorsal recumbency and the mouth was opened wide using a small mouth gag. The pharynx was packed with a moist bandage, and the palatal defect was cleaned with a mild antiseptic using a swab.

A flap was created by cutting a '∩' shaped mucoperiosteal strip from the hard palate, with the hinge at the edge of the defect. A recipient bed was created by undermining the edge of the cleft, except the hinge-edge. The flap was then folded over. Seven horizontal mattress sutures were preplaced using 3-0 and 4-0 vicryl. As these were tightened, the flap was tucked under the recipient flap with the oral mucosa facing the nasal cavity. Haemorrhage was controlled by swab pressure and recovery was uneventful. The cat was given a potentiated sulphonamide before surgery and this therapy was continued post-operatively.

Follow up

The flap was checked a day after surgery and was found to be in place. Ten days later the cat was re-examined. The owner reported that sneezing and nasal discharge had markedly reduced, though the cat occasionally sneezed after taking fluids. Oral examination revealed good healing and placement of the flap. A pin-hole defect was present in the centre of the flap. No treatment was given. It was recommended that the size of the hole be re-assessed at a later date.

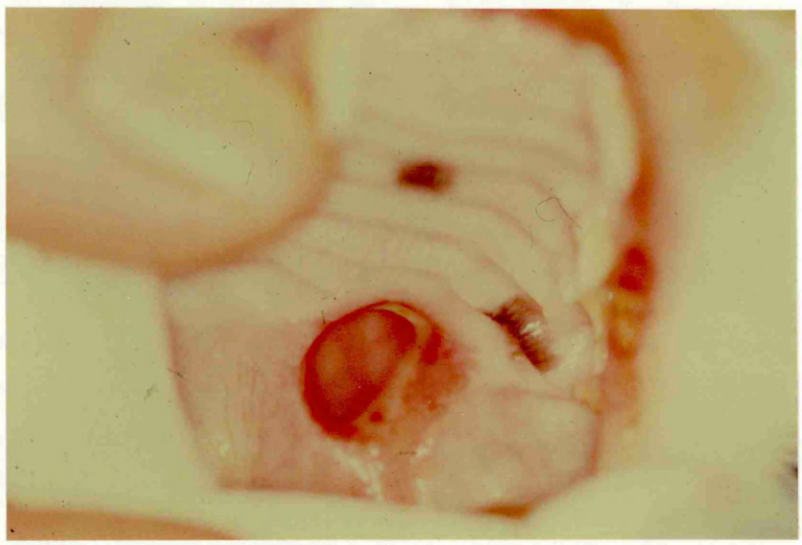

Fig. C5.1. Palatine defect. A circular traumatic palatal defect is clearly visible at the junction of the soft and hard palate.

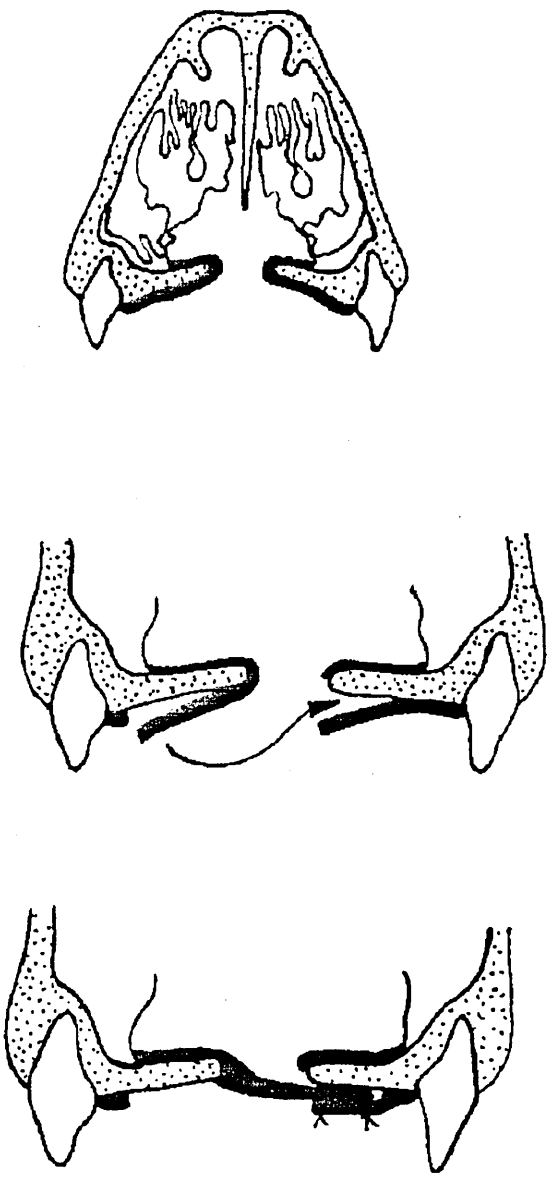

Fig C5.2. Principles of "sandwich repair".

DISCUSSION

Secondary palatal defects unlike the primary defects are frequently fatal if not corrected, due to aspiration pneumonia. Cosmetic appearance of the pup or kitten is the main indication for surgical correction of hare lip (primary palate defect) (Howard and others 1976). Euthanasia of puppies and kittens with palatine defects found soon after birth is done because the condition may be hereditary and also because of difficulties encountered in repairing the cleft in such small patients. Surgery is the sole method of treatment. Antibiotic therapy is indicated to control the rhinitis.

Fresh traumatic palate injuries should be repaired as soon as possible by simple suturing after making two relieving incisions, and by placing wires around the canine teeth and carnasial teeth for 3-4 weeks (Harvey 1985). Oro-nasal fistula are more easily repaired using buccal flaps (Lammerdig and others 1976). The Langenbeck technique of releasing longitudinal strips of mucosa from the hard palate and sliding them together towards the midline is useful in repairing small defects. The exposed external bone heals by granulation and epithelialisation. The disadvantage of this method when repairing large defects is the tendency for suture break-down, and a residual defect is often left rostrally or caudally (Thoday and others 1975). Therefore, it does not create a complete seal between the oral and nasal cavity.

The rotational (sandwich) method which was used in this case has been reported to give better results (Howard and others 1974). Wound break-down will take place if there is a lot of tension due to the small size of the flap. Flap size can also be the cause of incomplete closure of the defect. This calls for multiple surgeries before successful results are obtained. Wardrip (1982) carried out six surgical repairs over four months before achieving complete repair in a kitten. The author also observed that the total length of cleft grew with the kitten making the repair more difficult with time. Since the rationale behind surgery is essentially to prevent ingesta moving into the nasal cavity, it was decided not to pursue further surgery. Firstly, it is unlikely that a pin-hole defect would allow such egress considering the rapid flow of material to the pharynx. Secondly, repair of such a tiny defect would call for the creation of a flap out of all proportion to the pin-hole defect and would entail risking the already repaired larger defect.

The use of metal or acrylic implants in combination with, or as an alternative to suture techniques has been used successfully in management of cleft palate in dogs. These implants do give rise to periodontal diseases and they may then need to be cleaned, which may require subjecting the animal to a number of anaesthetics (Hobson and others 1971, Thoday and others 1975)

Defects of the soft palate are easier to repair as there is more tissue, hence less tension on the suture line. The soft palate may also be used as an advancement flap in covering defects of hard palate (Harvey 1985).

The success for surgical treatment of palatal defects depends on flap size and viability of the opposing tissue surfaces. Complications during surgery may be due to small size of patient making exposure of the site difficult. This can sometimes be overcome by using by-pass tracheostomy .

Pharyngostomy is indicated for aftercare in puppies or kittens that have undergone radical surgical repair (Howard and others 1974). None of the above procedures were thought necessary in this cat.

There are a number of reasons to explain the failure to recognise the cleft palate when the cat was first examined. The defect may not have been apparent as the mucosa was seemingly intact, or was very small at the time of examination, becoming bigger as the cat grew and clinical signs became evident.

The cause of the small hole in the centre of the flap seen ten days after surgery was likely to be due to stretching of the flap during the healing process, impairing the microcirculation focally.

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Case 6

DIAPHRAGMATIC RUPTURE IN A CAT

INTRODUCTION

Traumatic injuries are very common in small animals, arising most frequently from road traffic accident (RTA) injuries (Al-Nakeeb 1971, Kolata and others 1974).

Any region of the body may be affected, but orthopaedic injuries seem to be more common, since they are more obvious on clinical examination and are, therefore, given more attention. Internal injuries, which are more serious, can be overlooked (Walker and Hall 1965, Denny 1986) and of great importance are those chest injuries which affect organs vital to survival (Houlton 1986). Interestingly, there seems to be no correlation between rib fractures and internal thoracic injuries. Thus thoracic injuries may occur without an accompanying rib fracture. In one study of 600 RTA cases, in which 71 dogs had thoracic organ injuries, only nine had co-existing rib fractures (Kolata and others 1975).

A "blow" to the abdomen will cause intense pressure on the diaphragm as the abdominal organs are pressed against it. The diaphragm which is composed of only one layer of muscle and tendon gives at its weakest point (Hulse 1975).

The diaphragmatic tears are either circumferential which occur in a high percentage of cases, radial, "T"-shaped, or inverted "L"-shaped (Hulse 1975, Garson and others 1980, Sullivan and Reid 1990).

In general, clinical signs depend on the size of the tear, herniated organs and the chronicity of the tear. Small or chronic tears may not show obvious signs, though these can be aggravated by exercise (Al-Nakeeb 1971). Respiratory signs (dyspnoea, cyanosis) are seen more often in acute cases (Carb 1975, Garson and others 1980, Sullivan and Reid 1990), while the gastrointestinal signs become evident as the abdominal organs migrate into the thoracic cavity (Garson and others 1980). Migration of the abdominal organs may take days or years, especially if the tear is small, or if the omentum creates a seal in the hole. Importantly, presentation of diaphragmatic rupture can be at quite varying times after the causative insult (Carb 1975).

In man, left diaphragmatic tears are more common and this has been attributed to the fact that the right hemidiaphram is protected by the bulk of the liver. This seems not to be the case in small animals. Al-Nakeeb (1971) reported the right side to be more affected. Yet another report showed an equal incidence of both sides (Carb 1975).

The liver is the most frequently herniated organ. Other organs include the stomach, spleen, large and small intestine, omentum, and rarely the uterus (Tickle 1984, Sullivan and Reid 1990).

A history of trauma, presenting signs and physical examination, normally raise suspicion of diaphragmatic rupture. Chest radiography, with or without barium study, is used to confirm the rupture. Loss of normal outline of diaphragm or heart, displacement of structures within the thorax or abdomen, divergence of the diaphragmatic crura, presence of abdominal organs in the thorax are some of the recognised radiographic findings (Kealy 1979, Tickle 1984, Houlton 1986, Sullivan and Lee 1989).

Diaphragmatic ruptures are treated surgically. Timing of surgery is governed by the gravity of the clinical signs and the chronicity of the rupture. Prompt surgical intervention is indicated in acutely injured animals with severe respiratory signs, otherwise surgery may be delayed, especially in chronic ruptures and congenital hernias (Carb 1975). The co-operation of anaesthetist and surgeon is of paramount importance in ensuring survival of the patient. Close attention is required from the time the animal is admitted until discharge from the hospital.

Shock is a common finding and should be dealt with immediately to reduce anaesthetic complications (Al-Nakeeb 1971, Carb 1975). Fractures and dislocations of bones of the extremities, head and vertebrae may co-exist leading to traumatic shock, while head injuries may lead to upper airway obstructions due to accumulation of blood and mucus in the back of the pharynx. This requires immediate attention to clear the airway thus intubation or tracheotomy may be indicated

This report describes a cat suspected of having been injured in a road traffic accident and having sustained a diaphragmatic rupture and fracture of the skull.

CASE DETAIL

History

A five-year-old male neutered domestic short haired cat was presented to GUVH after it was suspected of having been involved in a road traffic accident three days before. Mild shock and oro-nasal bleeding of an acute onset were the presenting signs when first seen by the referring veterinarian. Intravenous fluids were administered to control the shock, and a mandibular symphyseal fracture was found on the second day of examination The cat was anaesthetised for fracture re-alignment, and thoracic radiographs were taken at the same time. These revealed an increase in soft tissue density in the thorax. On the third day the cat became dull, anorexic and tachypnoeic and was referred to GUVH.

Clinical Findings

The cat was dull, tachypnoeic, hyperpnoeic with respiratory rate of 36 per minute. Heart sounds on the left side were reduced with an increase in resonance on the same side. Palpation of the abdomen caused pain and the urinary bladder could not be palpated. The jaw was malaligned with caudal mandibular displacement.

Diagnostic Aids

A lateral chest/abdominal radiograph showed a masked diaphragmatic outline. Bowel gas was seen in the thorax ventrally. (Fig. C6.1).

Treatment

A diaphragmatic rupture was diagnosed and the cat was scheduled for surgical repair. The 3.5kg cat was premedicated with 20mg pethidine and 0.3mg atropine intramuscularly. The ventral abdomen was clipped prior to induction. The cat was pre-oxygenated with a mask, induced with propofol and intubated immediately after spraying the larynx with local anaesthesia. Oxygen and halothane were used to maintain the anaesthesia via the Ayre's T-piece circuit. Atracurium was used as the relaxant and intermittent positive pressure ventilation (IPPV) at twenty breaths per minute was started immediately.

The cat was placed in dorsal recumbency and the surgical site was isolated with sterile drapes. A cranial ventral mid-line incision was made through the skin and linea alba. Inspection of the diaphragm revealed a "T" shaped tear which was larger on the left side. The liver, spleen, omentum and a piece of small intestine were found in the thoracic cavity. These organs were gently withdrawn with ease since there were no adhesions. It was noted that there was virtually no diaphragmatic tissue left on the body wall for suturing. Therefore, horizontal mattress sutures were placed through the diaphragm and around rib eleven with knots tied abdominally. The vertical tear was closed with a mattress suture pattern. 2-0 silk was used throughout.

The laparotomy wound was closed in three layers. 2-0 vicryl was used to appose the linea alba and subcutaneous tissues. The skin was closed with 2-0 nylon. Ten mls of air were removed from the chest post-operatively using intravenous cannula, three-way tap and syringe.

Skull radiography showed fractures of the nasal bone, palatine bone and mandibular symphysis which had been repaired with a suture by the referring veterinarian. The temporo-mandibular joints were normal. These fractures were not tampered with despite the slight malocclusion, since the cat was able to eat.

Follow-up

A post-operative radiograph showed some pleural effusion, with all the abdominal organs back in the abdomen. The cat refused to eat or drink 24 hours post-operatively and was syringe fed. Pethidine was given as required. On the third day, the cat was bright and eating liquidised food. Ten days later the cat was re-examined, the wound had healed and the cat was in good form. The sutures were removed. The mandibular sutures were removed two weeks later.

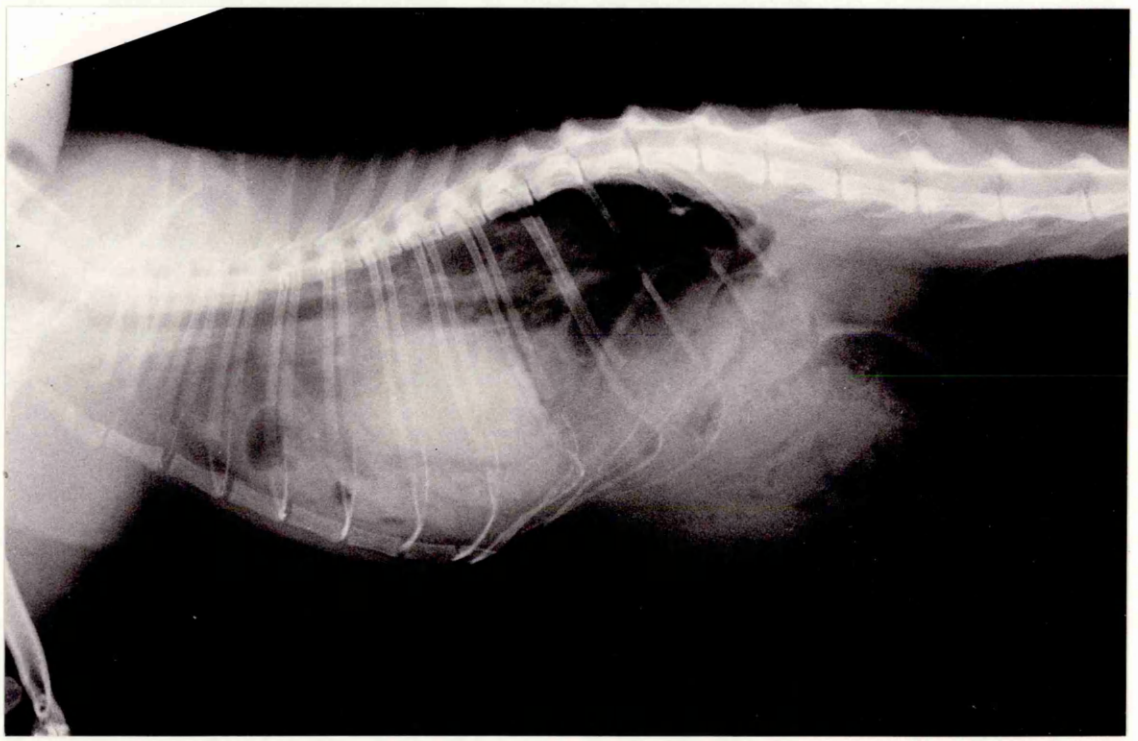

Fig. C6.1. Lateral thorax and abdomen. The diaphragmatic outline is unclear. The cardiac shadow is obscured by a soft tissue density, ventral to which a gas filled viscus is visible. In the abdomen the falciform fat and small bowel have been displaced cranially.

DISCUSSION

The severity of diaphragmatic rupture depends on the site and extent of the tear. Massive lung collapse will lead to sudden death, whereas simple herniation of abdominal organs may be tolerated for some time. Signs of diaphragmatic rupture may be overshadowed by those of traumatic shock where other systems (central nervous system, skeletal and abdominal viscera) have been injured.

Whenever road traffic accident injuries are suspected radiography of the chest should be done to check the state of the thorax. This will help to distinguish conditions such as pneumothorax or hydrothorax, which may have similar clinical signs (Al-Nakeeb 1971). Barium study can be used in suspected cases, although it may not be helpful at all times. Sullivan and Lee (1989) reported three cases where barium studies were unable to confirm the presence of rupture. This may be due to fluid masking the herniated organs, or absence of abdominal organs in the thorax despite the presence of the rupture. The size of the tear may contribute to this problem (Tickle 1984). Exploratory examination is therefore indicated.

Since the majority of these cases are associated with varying degrees of traumatic shock, action should be taken to prevent and reverse the shock. Cage rest and thoracocentesis in cases with hydrothorax may be indicated in order to stabilise the patient before surgery is undertaken (Sullivan and Reid 1990). However, delaying surgery in a patient with a tympanic stomach can be fatal. Surgery in such cases should be performed as soon as possible (Garson and others 1980, Sullivan and Reid 1990).

The survival rate of surgical correction of diaphragmatic ruptures differs greatly from one report to another, ranging from 58.2% success rate by Brodey and Sauer (1964) to as high as 90.2% in 32 cases by Walker and Hall (1965) Recently, Sullivan and Reid (1990) reported a success rate of 90% in 60 cases.

Garson and others (1980) investigated the causes of a poor survival rate of diaphragmatic hernia repairs at GUVH. It was found that death in patients prior to induction was mainly due to tympanic stomach, which can be avoided if surgery is done promptly (Sullivan and Reid 1990). Overdose of induction agents, wrong positioning of patient were some causes of death during induction. Hyperventilation can cause death during the surgical procedure. Care of the patient post-operatively for the first hour with chest drainage is indicated in severe hydrothorax (Sullivan and Reid 1990). Chest drains may also be left in place for emergency thoracocentesis. Cases have been known to deteriorate rapidly and eventually die after removal of the chest drain (Garson and others 1980). This could be attributed to rapid accumulation of fluid reducing lung capacity. Pneumothorax, pulmonary oedema and haemothorax were recognised as frequent causes of death post-operatively.

Patient stress should be kept to a minimum during anaesthetic induction. The animal is pre-oxygenated using a face mask if it will tolerate it for at least two minutes (Carb 1975, Al-Nakeeb 1971).

Induction of anaesthesia is achieved by an intravenous injection of an ultra short-acting barbiturate, and endotracheal intubation is done as quickly as possible. IPPV is started immediately and may be facilitated by use of a relaxant, especially in large and medium sized dogs (Sullivan and Reid 1990). Ventilation is continued post-operatively until the patient is able to breath by itself.

Re-expansion of the lungs should be done with caution as forced expansion causes damage to the lungs resulting in oedema, and is a common cause of death in the recovery period (Garson and others 1980).

Surgical approaches for repairing diaphragmatic rupture depends on individual preference. However, the ventral mid-line abdominal approach which offers a 360° visualisation is the preferred technique. Thoracotomy can be used in cases where adhesions are suspected, as it allows reduction of the herniated organs by exerting a pushing force against them (Hulse 1975). But it does not allow inspection of the abdominal contents. Thoracotomy is associated with a lot of pain post-operatively compared to laparotomy (Walker and Hall 1965). A paracostal approach was successfully used by Hulse (1965) but like thoracotomy, the side of the diaphragmatic rupture must be determined with absolute certainty before surgery.

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Case 7

SPHINCTER MECHANISM INCOMPETENCE IN A BITCH

INTRODUCTION

The urinary bladder is the main storage organ for urine. The anatomical position varies with the extent of distension, lying very close to the pelvis when empty, and cranial to the pubic brim when full.

In a non-voiding state, the intra-vesicular pressure is less than the intra-urethral pressure. When the intra-vesicular pressure exceeds the urethral resistance voiding is initiated. This phenomenon is under the control of sympathetic, parasympathetic, somatic pathways, reflexes and higher centres in the central nervous system (Chew and Dibartola 1986). Abdominal pressure, detrusor muscle and sphincter co-ordination are required for voluntary emptying (Darke 1983).

Urinary incontinence has been defined as the loss of voluntary control of micturition, which results in a constant involuntary passage of urine (Osborne and others 1972), and can affect both female and male dogs. Females being more susceptible (Holt 1985a).

The causes of urinary incontinence can be broadly divided into neurogenic, non-neurogenic, paradoxical and miscellaneous incontinence (Osborne and others 1972). In cases where clinical investigation and ancillary aids fail to provide a diagnosis, a presumptive diagnosis of physiological incontinence is made which may result from bladder sphincter mechanism incompetence, detrusor instability, or both (Holt 1984).

Urinary incontinence as a complication of ovariohysterectomy has been associated more frequently in young bitches neutered before puberty. It is less common in bitches neutered later in life (Joshua 1965, Finco and others 1979, Holt 1985a). Although the pathogenesis is not well understood, one theory (Finco and others 1979) is that incontinence is due to adhesions between the uterine stump and neck of bladder, creating a pull on the bladder sphincter when the stump contracts in older dogs. In most of these cases the bladder is found to be in an abnormal intrapelvic location and is elongated (White and Pomeroy 1989). This type of incontinence also occurs in entire bitches (Holt 1984). The intrapelvic location of the bladder has been reported in young and adults and in both continent and incontinent female and male dogs (Adams and Dibartola 1983). In young dogs it may be associated with a short urethra, considered to be congenital (Finco and others 1979, Holt 1985a). Congenital incontinence may resolve spontaneously around the first oestrus as the efficiency of sphincter control increases due to onset of puberty and gonadol hormone secretion (Holt 1985a). In neutered bitches the period from spey to onset of incontinence varies from immediate to a number of years (Holt 1985a).

The history, clinical signs and breed may lead to a tentative diagnosis. In general, large breed dogs suffer from this problem. Old English sheepdogs, dobermans and Irish setters appear to be over-represented (Adams and Dibartola 1983, Holt 1985a, White and Pomeroy 1989). Intravenous urography and retrograde vaginogram are confirmatory and all are employed to rule out other causes of urinary incontinence, such as ectopic ureters (Webbon 1982).

A number of different drugs have been used in an attempt to manage sphincter mechanism incompetence. Since this type of incontinence is associated with hypo-oestrogenism, oestrogen therapy has been the mainstay of medical therapy (Osborne and others 1972, Holt 1985a). Poor results have been obtained using emepronium bromide which is an anticholinergic drug (Holt 1984), while ephedrine, an alpha adrenergic, has been found to be unsatisfactory (Holt 1985a). Phenylpropalamine, a less toxic alpha adrenergic drug, has been shown to improve sphincter tone much more effectively. Its use in ten dogs gave very good results with only one failure (White and Pomeroy 1989).

There are few reports of surgical treatment of sphincter mechanism incontinence in dogs. Sling urethoplasty for treatment of urethral dilation and incontinence (Busby and Hanks 1980) and colposuspension for correction of intrapelvic bladder (Holt 1985b) have been successfully used.

In this report, the use of colposuspension in a bitch, which had become refractory to phenylpropalamine, is described.

CASE DETAIL

History

A 2.5-year-old female Boxer weighing 25kg was presented to GUVH with a history of dribbling urine soon after being neutered. The bitch had been neutered after her first oestrus. A few months later, the owner noticed a wet patch on the dog's bed in the mornings. Although this was intermittent, the frequency gradually increased and the dog was put on stilboestrol without any improvement. Phenylpropanolamine was then prescribed. The incontinence worsened and the dog was referred.

Clinical Findings

The dog was in good condition, but had a systolic murmur. The only finding related to the urinary tract was a wet vulva area.

Diagnostic Aids

A plain radiograph of the caudal abdomen showed a caudally placed urinary bladder neck This was confirmed by carrying out a retrograde vagino-urethrocystogram using Conray 280 at 1ml/kg (Fig. C7.1). Insignificant numbers of streptococci and micrococci were isolated from the urine culture.

Treatment

A diagnosis of sphincter mechanism incompetence associated with an intrapelvic bladder was made. Since medical therapy had failed, a surgical approach (colposuspension) to relocate the bladder to an intra-abdominal position was done using the technique described by Holt (1985). Routine anaesthesia was used (Appendix 1).

The caudal ventral abdomen was prepared for aseptic surgery. A Foley catheter was introduced and the urine was drained. The catheter was inflated with air and withdrawn to the bladder neck. The bitch was placed in dorsal recumbency with it's hind legs flexed.

A caudal midline ventral abdominal skin incision was made extending to the pubis. The subcutaneous tissue and fascia was undermined to expose the linea alba and the pre-pubic tendon on both sides. The incision was made into the linea alba and the cranial pole of the bladder was identified. The bladder was grasped with a pair of Allis tissue forceps and pulled gently cranially. Using blunt dissection, the pubo-vesical peritoneum and the fascia between the urethra and the pelvic floor were broken down to increase exposure. A gloved assistant's finger was inserted into the vulva and used to push the vagina cranially and laterally. The fat and fascia around the ventral bladder neck and proximal urethra were separated to expose the lateral vaginal wall. The lateral vaginal wall was grasped by Allis tissue forceps on both sides away from the proximal urethra and the assistant's finger was withdrawn. Relocation of the bladder was tested by pulling the vagina cranially using the forceps. Two "0" nylon sutures were preplaced in a mattress suture pattern through the vagina wall and around the pre-pubic tendon on each side. The Allis tissue forceps were removed. Tension was applied on the sutures and this resulted in a cranial shift of the bladder neck. The sutures were tied and a final check was carried out to ensure there was no urethral strangulation. The Foley catheter was deflated and removed. Potentiated sulphonamide was given intravenously during the operation and continued as a five-day course of tablets.

Follow-up

The dog was hospitalised for six days for observation. On the second day post-operatively, the dog passed a good stream of urine and this continued for the next five days. The dog was discharged on the sixth day since it was assumed to have responded to therapy. Three months later the dog was brought back for a recheck. The owner reported that the dog was continent. A recheck retrograde vaginogram was performed. This showed a cranial displacement of bladder neck (Fig. C7.2).

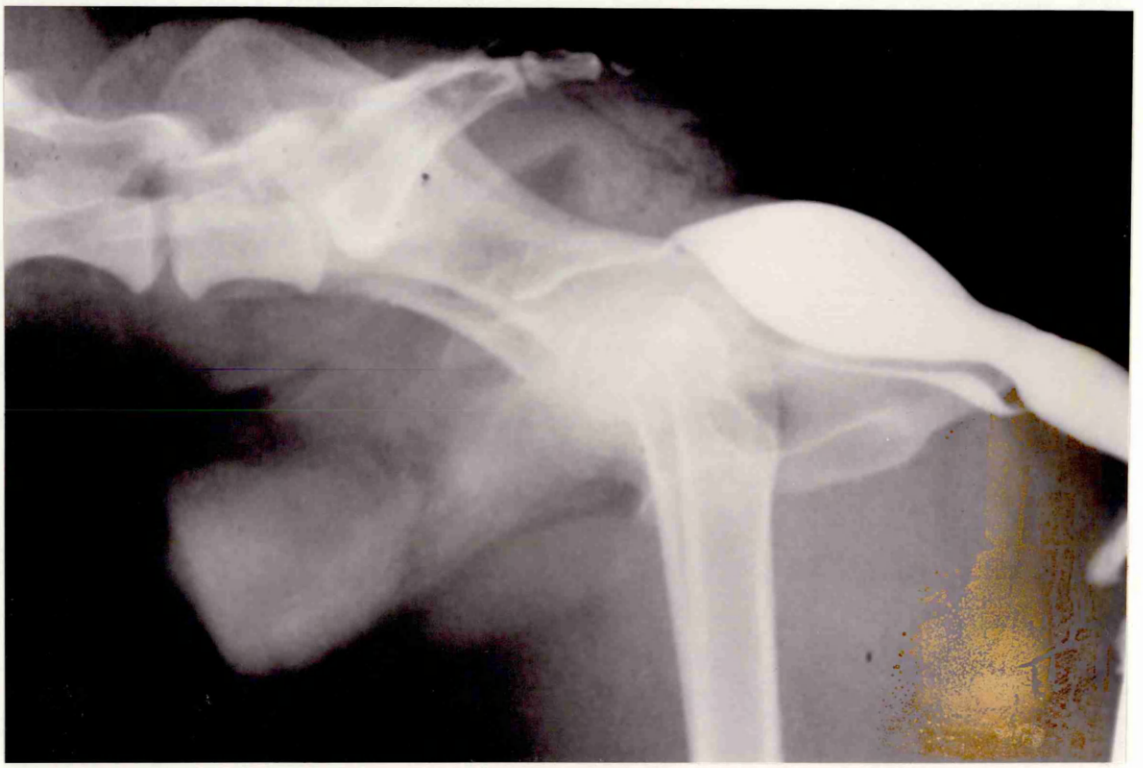

Fig. C7.1. Retrograde vaginogram. Pre-operatively, the contrast highlights a bladder neck which is intrapelvic.

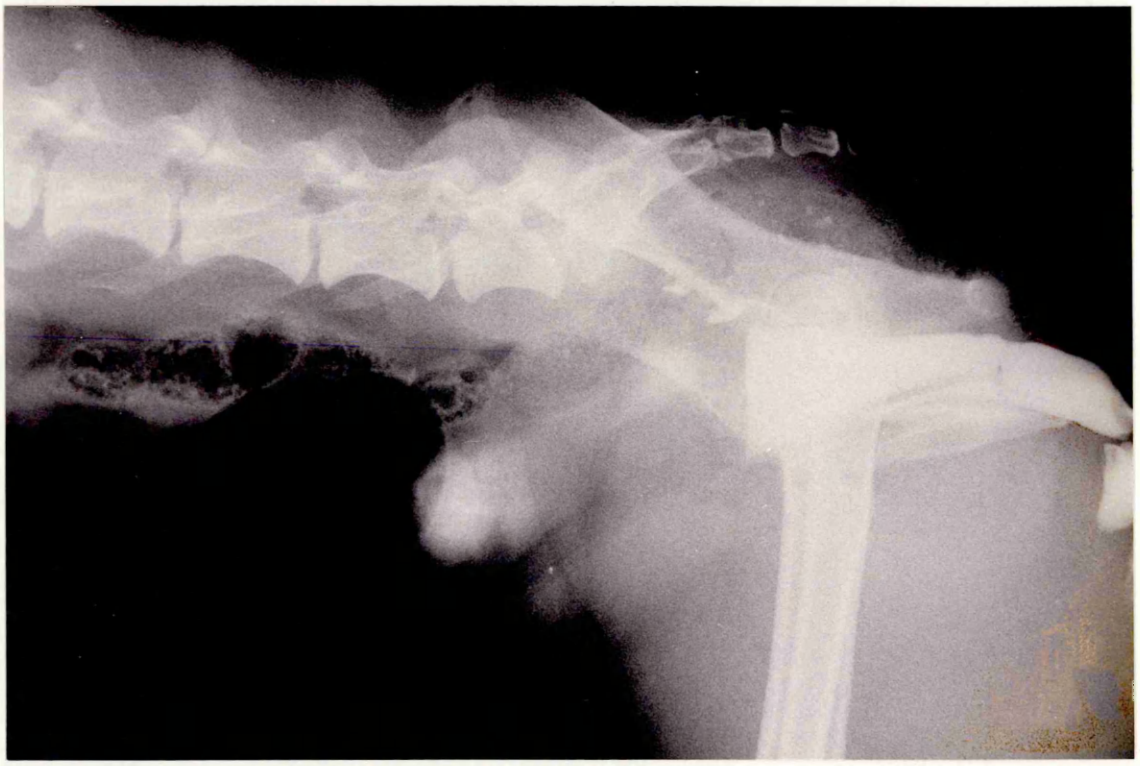

Fig. C7.2. Follow-up contrast study. Three months post-operatively, the vagina is now displaced cranially due to the pull of the suture material, and with it the bladder neck has been pulled forward.

DISCUSSION

Urinary incontinence must be differentiated from painful difficult urination, from frequent passage, and passage of large volumes of urine per unit time (Osborne and others 1972).

True incontinence is generally considered to occur when the animal is sleeping or recumbent, leaving a wet patch on the bed (Holt 1985a). Dogs have been noticed to be incontinent when moving or after a normal micturition (Busby and Hankes 1980) or when they attempt to jump into the car or on owner (Holt 1985a). Some are constantly wet and smelling of urine, with ulceration of the vulva or perineum (Pearson and others 1965). Incontinence associated with an intrapelvic bladder is assumed to be due to the fact that pressure exerted by the abdomen on the caudally placed bladder is not fully counteracted by the sphincter which is intrapelvic in position.

The pathogenesis of the oestrogen-responsive incontinence subsequent to ovariohysterectomy is not well understood. It is, however, theorised that this is due to adhesions between the uterine-cervical stump and neck of the bladder creating a pull on the bladder sphincter ([illegible], Finco and others 1979). About 1-10% of ovariohysterectomised bitches become incontinent (Holt 1983 and 1985a). However, ovariectomy does not seem to protect against incontinence suggesting that adhesions are not the cause (Lanssens and Janssens 1991).

Urinary incontinence occurred in 18% of the ovariectomised bitches as reported by the above authors. This strongly suggests hypo-oestrogenism as the cause of the incontinence in contradiction to the former assumption (Joshua 1965, Holt 1983, 1985a, Lanssens and Janssens 1991).

Response to oestrogen therapy in neutered bitches varies from no response to total response, with some cases becoming refractory to the treatment (Osborne and others 1972, Busby and Harkes 1980, Adams and DiBartola 1983). This may suggest that this type of incontinence is not just a hypo-oestrogen problem. Other debatable phenomena which come into play are: oestrogen-responsive incontinence which occurs in entire bitches (White and Pomeroy 1989), and the spontaneous resolution in some young bitches with congenital sphincter mechanism incompetence at the time of first oestrus (Holt 1985a).

Agents that directly stimulate the alpha receptors of the urethra, thus increasing the urethral resting time, have been used to treat sphincter mechanism incompetence. Phenylpropanolamine was very effective in nine out of ten dogs (White and Pomeroy 1989). Emepronium bromide as a parasympatholytic is reported to have worsened the condition in two dogs (Holt 1984).

The disadvantage of medical therapy is toxicity associated with the drugs. However, the alpha adrenergic agents are less toxic than oestrogens, whose side-effects include, bone marrow suppression. Some animals will become refractory to the drug and require increased dosage thus increasing the risk of toxicity. The major side-effects of the alpha adrenergic drugs are excitability and tachycardia (Krawiec 1989).

Consideration should be given to the possibility that sphincter mechanism urinary incontinence is mulitfactorial, which may be the reason for both medical and surgical treatment failure. Hence, a combination of both methods of therapy may be called for (Busby and Hankes 1980). A mild bacteruria which is responsive to antibiotic therapy may be present in some incontinent dogs, and may be due to pooling of urine or the constant flow of urine acting like a wick (Holt 1985b).

To maintain continence, the pressure in the bladder neck and urethra should exceed that in the body of the bladder (Mitchell 1984). Intra-abdominal relocation of the bladder is the hallmark of colposuspension. This technique enables exertion of abdominal pressure on the bladder neck and urethra when they are in an abdominal location (Holt 1985b).

Animals that are refractory to drug therapy are candidates for colposuspension. Colposuspension may also be indicated when the owner of the dog declines medical therapy. The time taken to improve after colposuspension may be from less than 24 hours to 3 months, with the majority improving within 3 days (Holt 1985b). The case presented here showed improvement after two days.

Complications associated with colposuspension are relapse if the sutures are tied to the rectus abdominus muscle, breaking or loosening of the suture material and dysuria due to voluntary dyssnergia (Holt 1985b). No such complications were seen in the case presented in this report, therefore, colposuspension was used successfully in eliminating the clinical signs of urinary incontinence in the dog when examined three months after surgery.

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Case 8

TEMPOROMANDIBULAR JOINT ANKYLOSIS IN A CAT

INTRODUCTION

The temporomandibular joint (TMJ) is a condylar joint with a free range of movement. Normal opening and closing of the mouth depends on this joint. Joint mobility maybe affected by congenital, developmental, or acquired lesions. Traumatic acquired lesions are common and lead to joint fusion or ankylosis which affects jaw movement, position and dental occlusion.

Craniomandibular osteopathy which affects puppies causes reduced jaw and TMJ movement (Lane 1982). Acquired causes include neoplasia (Lantz 1985), extension of bulla osteomyelitis secondary to otitis (Lane 1982), and trauma which has been reported as being the most common cause in both dogs and cats (Lane 1982, Lantz 1985, Van Ee and Pechman 1987, Sullivan 1989). Either unilateral or bilateral involvement of the joint maybe encountered resulting in asymmetry of the face, or symmetrical shortening of the mandible respectively (Lane 1982).

The clinical findings are determined by the cause, age of patient and severity of the ankylosis. The usual presenting sign of TMJ ankylosis is inability to open the mouth completely (Lane 1982, Lantz 1985, Sullivan 1989). Other signs that have been reported are weight loss, unkempt hair coat, periodontal disease and salivation. Diagnosis of TMJ ankylosis may be made from the clinical presentation and physical examination. Myositis should be considered as a potential diagnosis in the dog presented with restricted mouth opening. Radiography of the whole skull in oblique and lateral views will demonstrate the extent of joint involvement, fractures or soft tissue masses (Lantz 1985).

Management of TMJ ankylosis by unilateral or bilateral condylectomy in both dog and cat have given satisfactory results (Tomlinson and Presnell 1983). Corticosteroids may be used to relieve symptoms and to prevent re-ankylosis (Bennet and Campbell 1976). Post-operative complications include re-ankylosis, severe malocclussion and facial nerve paralysis (Lantz 1985).

The case presented in this report had both clinical and radiographic evidence of a traumatic TMJ ankylosis resulting in facial asymmetry, incomplete opening of the mouth and facial nerve paralysis.

CASE DETAIL

History

A ten-month-old male neutered domestic short hair cat was presented to GUVH because it was having difficulties opening its mouth. The cat was obtained from the Cat Protection League at the age of four months. At that time the cat's tongue was seen to protrude slightly. As the cat grew the lingual protrusion became

more pronounced and the interincisor gap decreased. Some facial deformity became evident. The owner was advised to feed liquidised food which the cat could lap, and antibiotics were prescribed for the gingivitis.

Clinical Examination

The cat was thin with a dull coat. Facial asymmetry was obvious and the right side of the face was bigger than the left with signs of facial nerve paralysis. The lower jaw was very undershot and the tongue was hanging out, but it could be retracted (Fig. C8.1). There was halitosis, drooling of saliva, gingivitis and malocclusion. There was no obvious pain on gentle manipulation of the jaw. Movement was very slight with an interincisor gap of about 2-3mm.

Diagnostic Aid

Dorsoventral, lateral and oblique skull radiographs revealed gross deformation and shortening of the left mandible, causing deviation of the symphysis to the left. The left TMJ could not be discerned with clarity. The zygoma on the left was irregular and thickened, and the premaxila appeared to be curved towards the left, indicating healed fractures (Figs. C8.2, 8.3).

Treatment

The cat was premedicated with acetylpromazine glycopyrrholate and pethidine. Oxygenation by mask was done as the cat was induced with propofol. The endotracheal tube was introduced through a tracheostomy and anaesthesia was maintained using oxygen, halothane and nitrous oxide.

The cat was placed in right lateral recumbency and the area around the TMJ was prepared for aseptic surgery. Sterile drapes were placed to isolate the surgical field. A 4cm long skin incision was made over the left zygomatic arch. A large amount of fibrous tissue was found and removed using ronguers and small bone cutters. Movement of the mandible was assessed. There was no appreciable change. A 4cm interincisor gap was achieved after excising two thirds of the caudal zygomatic arch and the entire vertical ramus of the mandible. The overlying muscles and subcutaneous tissue were closed with 2-0 vicryl in interrupted sutures. The skin was closed with 2-0 nylon. Analgesics were given during the operation.

A final check of jaw movement and oral cavity was done and at this point a defect was seen in the hard palate with granulation tissue, and an iatrogenic mucosal tear laterally was repaired with 3-0 vicryl.

Recovery from anaesthesia was uneventful. Analgesics were injected post-operatively as needed since the cat was crying and uncomfortable. Metronidazole and ampicillin were prescribed. On the second day post-operatively, the cat was eating voluntarily.

Fig. C8.1. Head. Note the marked shortening of the lower jaw.

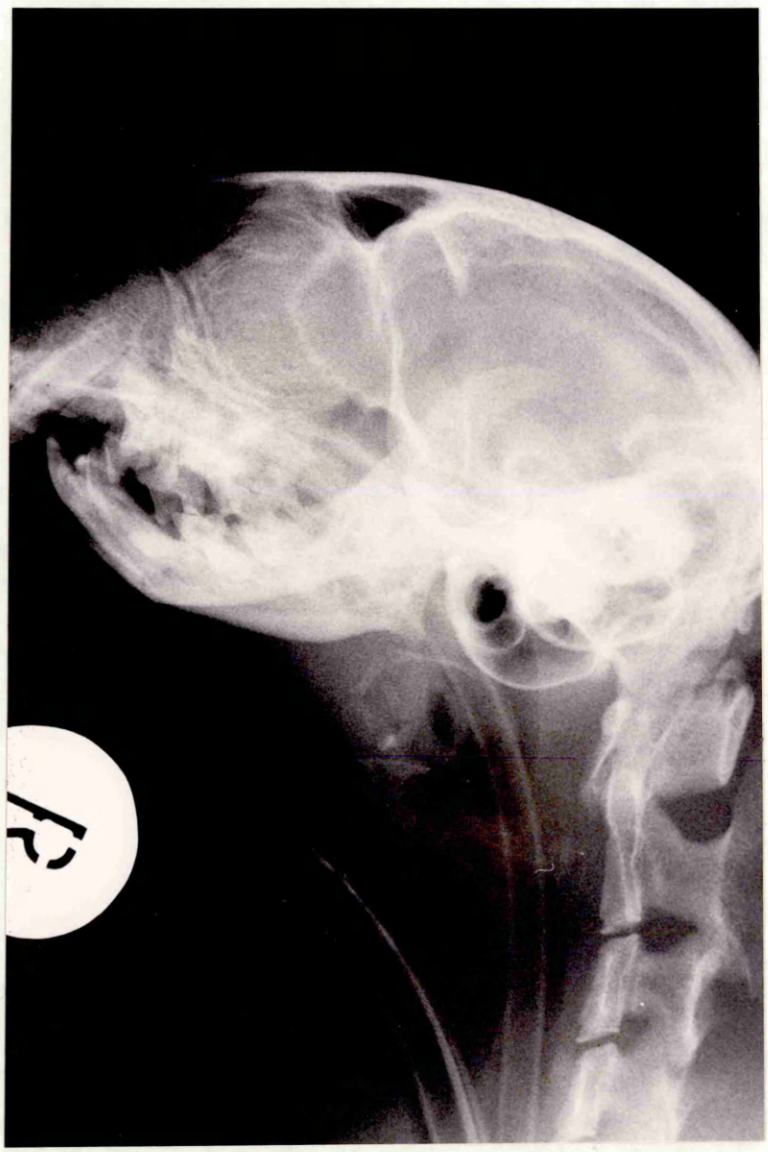

Fig. C8.2. Lateral skull. There is pronounced malocclusion and the mandible is shortened.

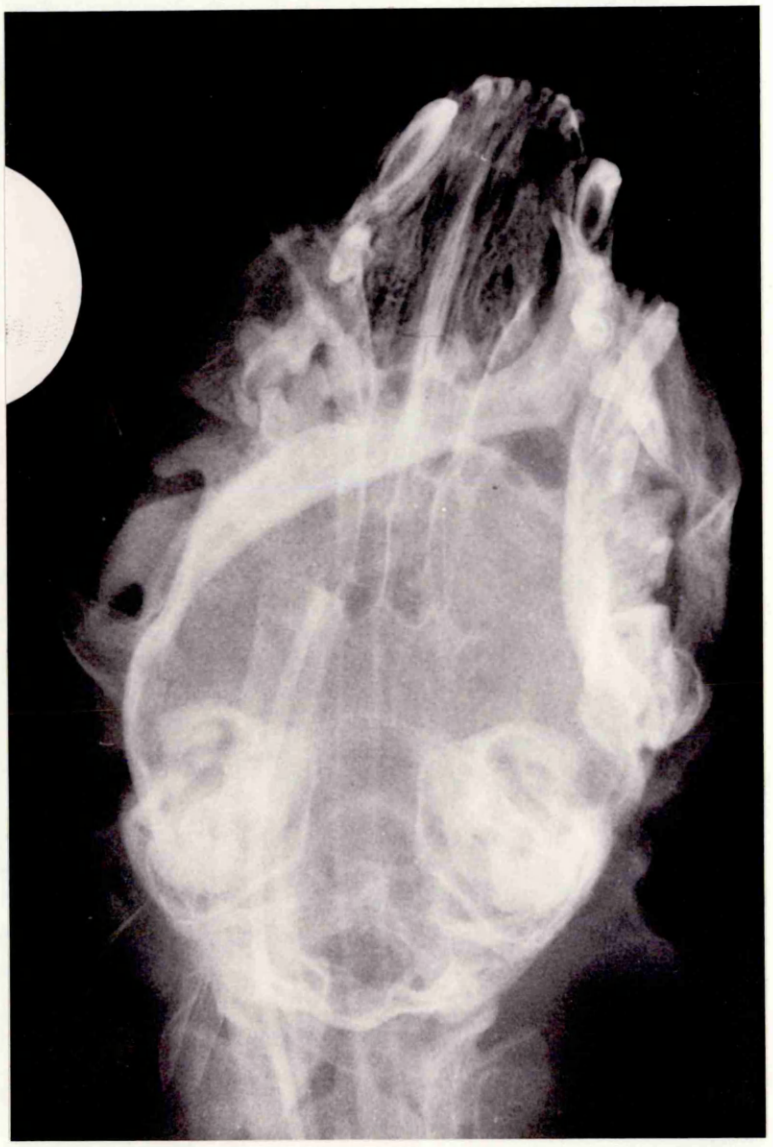

Fig. C8.3. Dorso-ventral skull. Note the gross deviation of the mandible towards the left. The temporo-mandibular joint cannot be clearly visualised on that side because of the proliferation of new bone.

Follow up

The cat was re-examined two weeks later. The wound had healed well, prehension and mouth opening were encouraging with an inter-incisor gap of 5cm. The cat had put on weight and the coat was cleaner. The facial paralysis seen prior to surgery was still present. Pupillary reflex was present in both eyes. The gingivitis had improved markedly, with slight salivation and tongue protrusion remaining. Three months post-operatively, the cat was brought back because it was reluctant to eat, was beginning to lose some weight and mouth opening had reduced slightly. On examination, jaw manipulation caused a painful reaction and periodontal disease had set in again. Radiography of the skull showed no evidence of re-ankylosis, and another course of antibiotics was prescribed after dental cleaning under general anaesthesia.

The owner was contacted by telephone one month later and she reported that the cat was eating well with an acceptable jaw movement and mouth opening. The periodontal disease had cleared and the cat was starting to gain more weight. However, she was aware that some pain could still be elicited on jaw manipulation.

DISCUSSION

The common cause of TMJ ankylosis in man is childhood trauma (Miller and others 1975). However many veterinary cases are presented with an unknown cause. Although haemarthrosis of TMJ has been implicated in man, most cases in the cat have evidence of having sustained fractures to the mandible whether intra- or extra-articular (Sullivan 1989). But this does not exclude the possibility that haemarthrosis may play a part in the ensuing ankylosis. Unilateral and bilateral involvement of the TMJ have both been reported. The result of ankylosis of the joint(s) is difficulty in jaw movement and an inability to open the mouth completely. The size of the mouth opening maybe reduced to such an extent that the tongue[15] only just able to protrude. This leads to difficulties in eating and prehension. Animals are therefore presented with loss of body weight due to malnutrition, and unkempt coats in cats because of the inability to groom. All these signs were present in this cat.

In order to demonstrate TMJ disorders, fractures of the facial bones, osteoarthritic and inflammatory changes, radiography of the whole skull has to be done. Dorsoventral, lateral and oblique views will demonstrate most of the abnormalities (Ticer and Spencer 1978, Lane 1982).

In the past, treatment of TMJ ankylosis was attempted by simple traction to break the bony fusion and fibrous tissue. This method is not recommended as it is very likely to produce iatrogenic fractures. Corticosteriods may be used where owners decline surgical treatment. This will however only relieve the symptoms and may exacerbate the accompanying periodontal disease (Sullivan 1989).

Long term management of TMJ ankylosis is by surgical intervention. This is achieved by partial resection of zygomatic arch, coronoidectomy, condylectomy and resection of all diseased tissues adjacent to the joint (Lane 1982, Lantz 1985, Sullivan 1989). A tracheostomy was performed in this case because it was impossible to carry out normal endotracheal intubation due to the marked inability to open the mouth. Intravenous anaesthesia maybe used as an alternative (Lane 1982).

The interincisor gap should be used to determine how much bone can be removed. The aim of the surgery is to improve joint mobility and to increase the interincisor gap, hence to restore prehension and relieve pain. Restoration of occlusion to a perfect scissors bite is not always possible and is not a priority. Voluntary alimentation is normally noted the first day after surgery (Lantz 1985).

The size of the improved interincisor gap maybe maintained or there may be a slight reduction during the healing process (Sullivan 1989). Some cases may need a second operation due to marked re-ankylosis (Bennett and Campbell, 1976). This complication may be due to incomplete bone removal, or infection and excessive haemorrhage which promotes fibrosis (Lantz 1985).

The severe periodontal disease in this cat was due to malocclusion and lack of oral hygiene. The severity of ankylosis coupled with fractures of the zygoma and maxilla and presence of the palatine defect made management of the case very difficult. Three months post-operatively the cat was presented with loss of weight pain on jaw manipulation and reluctance to open the mouth. This improved after dental cleaning and antibiotic therapy. The general condition of the cat was reported to have improved four months later.

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Case 9
ECTOPIC URETER IN A BITCH

INTRODUCTION

Ectopic ureter is a congenital defect arising from faulty differentiation of the mesonephric and metanephric ducts (Christie 1985, Owen 1973) and results in incontinence. It is diagnosed more often in female than in male dogs (Osborne and others 1972, Owen 1973, Smith and others 1981, Webbon 1982), and it is said to be congenital although very few cases are diagnosed as being incontinent at birth due to failure of owner to recognise the problem (Osborne and others 1972, Owen 1973).

The incontinence maybe continuous or intermittent, with or without intervals of normal micturition. Excoriation of the perineal area, wet hairs around the vulva and hindlimbs, and a dog that smells of urine are typical findings (Pearson and others 1965, Holt and others 1982, Tabar and others 1991). Most ectopic ureters are unilateral and are equally distributed between right and left sides (Smith and others 1981, Holt and others 1982). Other conditions that have been found to cause urinary incontinence include ureterocoele, cystic hypoplasia, morphological abnormalities of the bladder neck and urethra, pervious urachus and sphincter mechanism incompetence (Smith and others 1981, Webbon 1982).

Since ureteral ectopia is the most frequently diagnosed cause of juvenile urinary incontinence, a history of an incontinent young bitch should give a presumptive diagnosis of ectopic ureter and this can be confirmed by intravenous urography (IVU) and retrograde vagino-urethrocystography (Webbon 1982). Particular breeds appear to be predisposed to this condition. Howard (1984) reported high incidence of ectopic ureters in Siberian husky, Newfoundland, bulldog, West Highland white terrier, fox terrier, miniature and toy poodle.

The only treatment for ectopic ureter is surgical reimplantation or ureteronephrectomy, since no medical treatment is effective. The choice of surgical procedure is based on the functional capability of both kidneys.

The incontinence in this dog presented in this report was noticed soon after weaning. An ectopic ureter was diagnosed, but surgical repair was delayed in view of the dog's age.

CASE DETAIL

History

A two-month-old female labrador retriever (7.5kg) was presented to GUVH with a history of urinary incontinence since birth. She could pass a normal stream of urine, but was also intermittently dribbling urine unconsciously during walks or when lying down.

Clinical findings

The vulva and inside of the hindlegs were wet with excoriation of the caudal ventral abdomen (Figs. C9.1, C9.2). The dog smelt strongly of urine.

Diagnostic aids

A retrograde vagino-urethrocystogram using Conray 280 at 1ml/kg was performed using a small dog catheter. The catheter was secured at the vulva using bowel clamps. Lateral and dorso-ventral caudal abdominal radiographs taken immediately after injection revealed a tortuous dilated right ureter (Figs. C9.3, C9.4).

Fig. C9.1. Incontinent bitch. The hair around the back, legs and tail is soaked with urine.

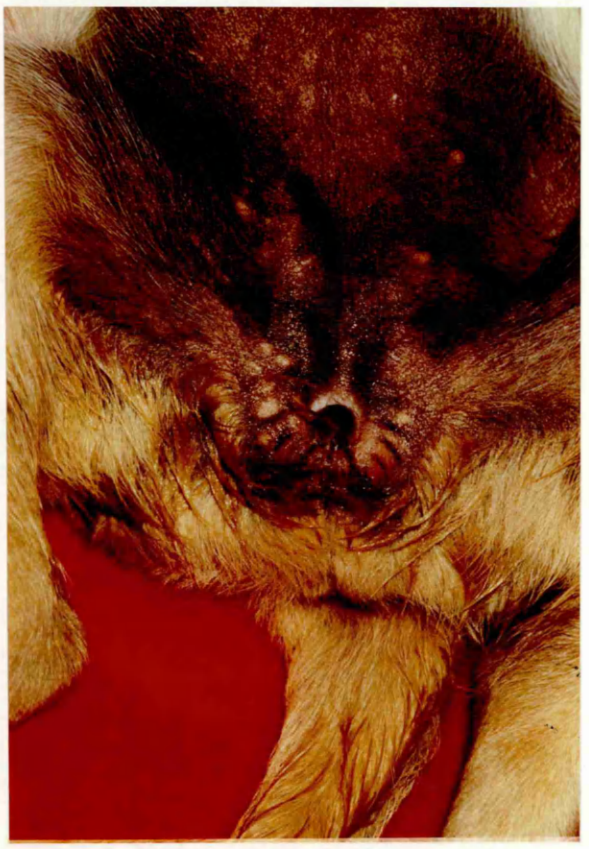

Fig. C9.2. Incontinent bitch. The same dog showing marked excoriation of the caudal ventral abdomen and the vulva.

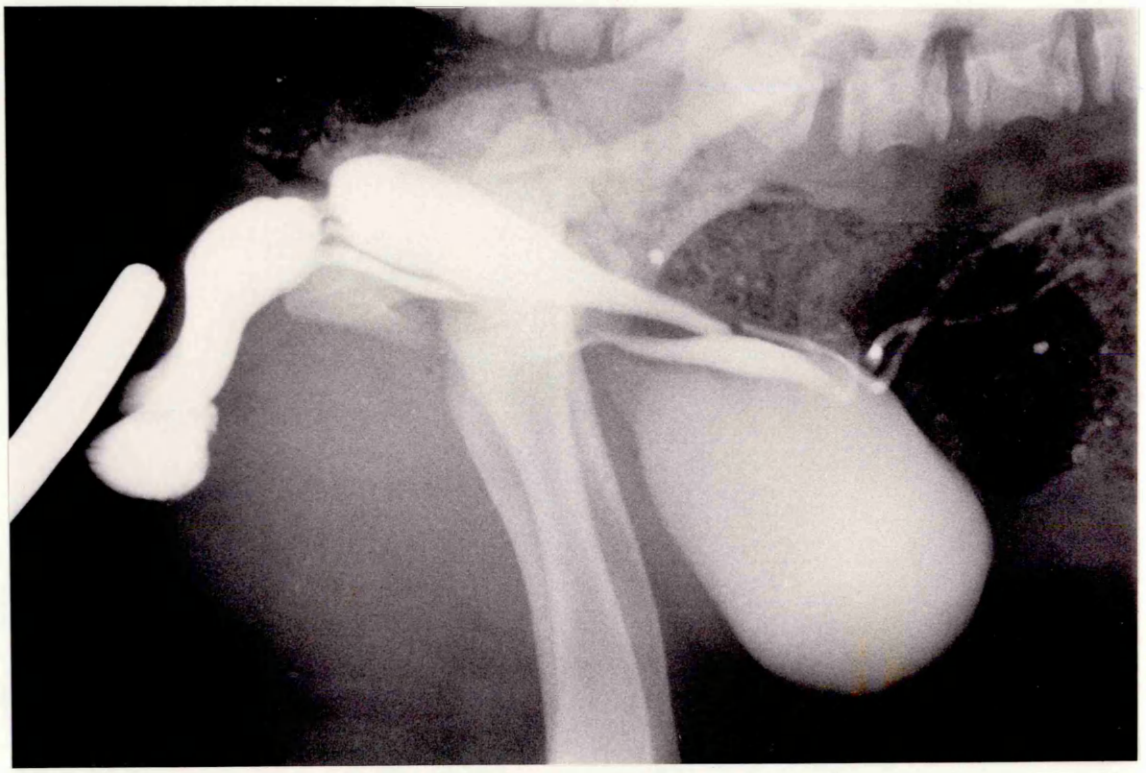

Fig. C9.3. Retrograde vaginogram. A distended ureter can be distinguished lying above the urethra at the level of the bladder neck. The ureter appears to terminate in the vagina. (Lateral view caudal abdomen and pelvis)

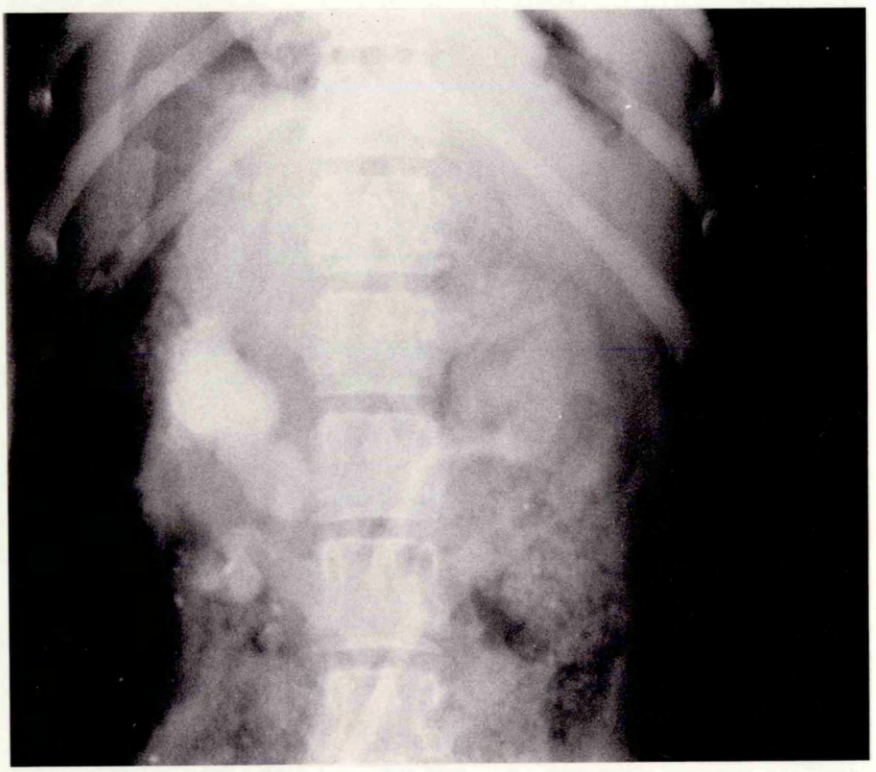

Fig. C9.4. Intravenous urography. A dilated renal pelvis is evident, with a distended right ureter leaving the kidney.**(Ventro-dorsal view)**

Treatment

A right ectopic ureter was diagnosed radiographically. In view of the dog's age, surgery was postponed until the dog was sixteen weeks old. Routine anaesthesia was used (Appendix 1). The bladder was catheterised and emptied. The caudal ventral abdomen was prepared for aseptic surgery with the dog placed in dorsal recumbency. A dose of ampicillin was given just before surgery commenced. A caudal ventral midline skin incision was made and the abdomen was opened via the linea alba. The urinary bladder was exteriorized and examined. An approximately 1cm diameter right ureter was found running intramurally. The left ureter was of normal size and emptied into the trigone area of the bladder. A midline incision was made on the ventral surface of the bladder. The part of the ureter close to the bladder was freed from the surrounding fascia and a stay suture was placed through the ureter close to the bladder. A haemostat was placed between the suture and the bladder. A 2-0 vicryl ligature was applied below the heamostat and the ureter was transected. A small elliptical piece of bladder mucosa was snipped off with a pair of scissors on the dorsal surface. An artery forceps was passed through the cut mucosa and directed below the mucosa to create a tunnel through the bladder wall a short distance from the opening in the mucosa. The stay suture was clamped with artery forceps and the ureter was drawn through the tunnel into the urinary bladder. The end of the ureter was spatulated by cutting it at an angle and sutured to the bladder mucosa with 4-0 vicryl in an interrupted suture pattern. Haemorrhage was controlled by ligation. A ligature on the ureter slipped during the ureterovesical anastomosis. This resulted in accumulation of blood submucosally. The sutures were removed and the vessel was identified and ligated again. This stopped further blood accumulation. The ureter was then re-sutured to the bladder mucosa.

The ventral bladder wall was closed using an inverting suture pattern with 3-0 vicryl. The abdominal incision was closed in three layers. 3-0 PDS (Polydioxanone) was used to appose the linea alba and 3-0 vicryl in the subcutaneous layer. The skin was closed with 3-0 nylon.

Follow up

Recovery from anaesthesia was uneventful. The dog was put on ampicillin tablets for a week. She was straining the day following surgery. Dribbling continued for the next five days that the dog was kept in hospital. The dribbling continued for a further two weeks and was thought to be due to an induced cystitis. Four months after surgery, the bitch was completely continent.

DISCUSSION

Urinary incontinence is one of the signs of urinary system anomalies. The history may be that of recent onset of incontinence seen in older dogs or it may be present from birth. Most of the dogs that have been diagnosed as having ectopic ureters are presented at the age of four months and older (Pearson and others 1965, Webbon 1982, Tabar and others 1991). The signs of incontinence are usually missed by the breeders during the time when the puppies are still receiving maternal care. Hence, most cases are seen at or after weaning as the care from the bitch diminishes (Webbon 1982).

In the male dog, ectopic ureter is rarely identified (Holt and others 1982, Howard 1984, Webbon 1982). This is assumed to be due to the length of the urethra (Rawling 1984), when compared to the short female urethra.

Dogs with unilateral ectopic ureter will be able to micturate normally, due to filling of the bladder from the normal ureter (Webbon 1982, Tabar and others 1991). Tabar and others (1989) are of the opinion that in bilateral ureteral ectopics there is continuous dribbling without any normal micturition. While Holt and others (1982) have reported normal micturition even from cases with bilateral ectopic ureters due to reflux of urine into the bladder from the urethra or bladder neck, or due to ureteral duplication as has been reported in man (Webbon 1982). Thus making a clinical differentiating of unilateral and bilateral ectopic ureters difficult contrary to Tabar and others (1991).

Radiography is of great value in determining causes of urinary incontinence. In ectopic ureters, retrograde vagino-urethrocystogram will demonstrate the distal insertion of the ureters, which are often not clearly shown by IVU (Holt and others 1982). A high dose of contrast is required to reach the terminal ureters with an IVU. Visualisation of an ectopic ureter maybe difficult because the ureter may course under the serosa of the urinary bladder and appear to be empting into it (Webbon 1982). However, a dilated ureter should provide a high index of suspicion of ectopic ureter (Pearson and others 1965). An ipsilateral hydronephrosis is very likely to be present (Holt and others 1982).

Ectopic ureters should be corrected surgically. Ureteronephrectomy or uretero-vesical anastomosis may be used depending on the state of the kidneys. In uretero-vesical anastomosis an attempt should be made to maintain or to create a valve effect at the distal end of the ureter so as to prevent vesico-ureteral reflux (Dingwall 1976). The standard textbook technique for correcting intramural ureters is that of creating a stoma and ligating the distal end of the ureter (Rawling 1982). The tunnel technique was used in this case to create obliquity at the distal end of the ureter hence creating the valve effect. Ureteronephrectomy is indicated in cases with severe hydronephrosis or kidney hypoplasia. Some of the complications encountered after uretero-vesical anastomosis are severe bladder oedema especially in juvenile animals,

breakdown of uretero-vesical anastomosis, relapse of the incontinence, partial obstruction or vesico-ureteric reflux (Holt and others 1982). Pearson and others (1965) reported abscess formation of the ureter if the ureter is not cut close enough to the bladder.

Ureteric submucosal blood accumulation was encountered in this case due to a slipped ligature. This was corrected immediately otherwise it would have resulted in submucosal haematoma formation with consequent ureteral obstruction, hydroureter and hydronephrosis.

Surgical treatment is not always successful in eliminating the clinical signs. Some animals will remain incontinent even after a successful surgery due to coexisting anomalies of the urinary system. Some animals will become continent after some time post-operatively due to an initial bladder overload which gradually accommodates to increased urine volume (Holt and others 1982). However many of the surgical failures may well have a concomitant sphincter mechanism incontinence.

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Case 10

PHARYNGEAL STICK INJURY IN A DOG

INTRODUCTION

Retropharyngeal tissues may be traumatised via the skin following puncture wounds from bites, shotgun pellets or thorns (Baker 1972). However, the most common cause of injury are oral foreign bodies that penetrate through the tonsillar crypts or wall of the pharynx, if they are not swallowed. Bones, needles, grass awns, pieces of wood and pins are some of the foreign bodies that have been retrieved from the oral cavity (Hallstrom 1970).

The most frequent sequel to long standing wounds from such foreign material is an abscess or a discharging sinus of the head, neck or cranial thorax depending on the angle of penetration (White and Lane 1988).

Recent injuries may present with sudden onset of salivation which may be blood-tinged saliva, dysphagia or dyspnoea and oral frenzy (Baker 1972, White and Lane 1988). This differs from chronic injuries which present with less severe signs of persistent discharging sinus or recurrent fluctuating swellings, which periodically rupture releasing sero-sanguinous fluids (White and Lane 1988).

Antibiotic therapy and local defence mechanisms may contain the foreign body in connective tissue and delay, or prevent abscess formation. Neck pain and dysphagia may be reported once treatment is stopped. A foreign body that penetrates the temporal and masseteric region via the tonsillar area or caudal to the last molar will cause retrobulbar swelling, enophthalmous with protrusion of nictitating membrane and pain on opening the mouth.

The most serious complication occurs when a foreign body penetrates the dorsal pharyngeal wall resulting in oesophageal rupture and mediastinitis (White and Lane 1988).

Treatment of pharyngeal foreign body injuries is usually successful whether a foreign body has been recovered or not. White and Lane (1988) analysed sixty-five dogs, foreign bodies were recovered from 57%, no foreign bodies were retrieved from 20% of the dogs. Treatment was successful in both groups. Significantly, a number were found to have been poorly managed prior to referral.

Masses which may be confused with swelling caused by oral foreign body injuries include sialocoeles (Glen 1972), para aural abscesses (Lane and Watkins 1986), retropharyngeal abscesses, cervical lymphadenopathy, oedema and emphysema. Rarely, neoplasia of the thyroid and salivary glands, calcinosis circumscripta and branchial cleft and thyroglossal duct cyst (Lane 1982) are reported.

Diagnosis can be aided by a thorough external examination, aspiration of the mass, caudal rhinoscopy, laryngoscopy, oesophagoscopy and radiography (Lane 1982).

A case of a seven year old labrador with a known history of stick penetration is presented in this report.

CASE DETAIL

History

A seven-year-old female neutered Labrador was presented to GUVH with a history of having run onto a stick four weeks previously. The owner had pulled the stick out and presented the dog to the referring veterinarian. Following a week long course of broad spectrum antibiotics, the dog developed a fluid swelling in the submandibular area, was reluctant to eat and drank very little. The swelling was lanced, explored and a stick was removed from the neck region.

At presentation, the owner reported that the swelling kept bursting and refilling, releasing bloody watery fluid.

Clinical examination

A mass was palpated in the right submandibular area. Blood tinged discharge oozed out when the mass was palpated. A sinus was located at the level of the thoracic inlet. No lesion was visible in the oral cavity. *Staphylococcus intermedius* was isolated and was sensitive to broad spectrum antibiotics. A complete blood count revealed a leukocytosis.

Treatment

A diagnosis of a pharyngeal stick injury was made from the history and clinical findings, and a radical exploration and curettage of the tracts planned.

Routine anaesthesia was done (Appendix 1). The ventral and lateral sides of the neck were prepared for surgery. The dog was placed in dorsal recumbency. A longitudinal incision was made over the swelling and a sinus tract was identified. Dissection was continued through the connective tissue and muscles of the neck taking care not to damage major structures (nerves and blood vessels).

At the level of the fourth and sixth cervical vertebrae a 7x3cm piece of wood was found and removed (Fig. C10.1). More smaller tracts were identified, these were removed by aggressively curettage, including the surrounding granulation tissue. Normal saline was used to flush the wound.

A Penrose drain and a tube drain were placed across the wound and flushed twice daily for two days with normal saline. The muscle and subcutaneous tissues were apposed using 2-0 vicryl and skin was closed with 2-0 nylon.

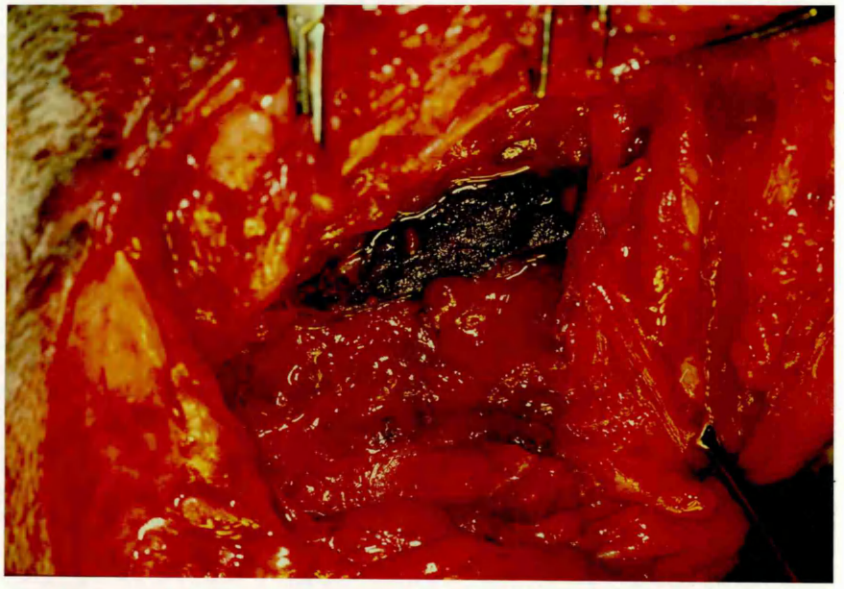

Fig. C10.1. Intra-operative view of neck. At the level of the fourth to sixth cervical vertebrae, a large piece of wood can be seen embedded in the soft tissues of the neck, surrounded by granulation tissue.

Follow up

Recovery from anaesthesia was uneventful. Trimethoprim-sulphonamide was prescribed for four weeks. The dog was eating well and was discharged four days after surgery.

DISCUSSION

Swellings in the cervical region may not be visible externally due to looseness of the skin of the neck and long hair in some breeds of dogs. Thus a progressive swelling may escape unnoticed until it is sizeable. The most frequently encountered swellings of this region are sialocoeles and abscesses, which are usually fluctuating fluid-filled masses. Differentiation is possible from macroscopic examination of the mass aspirate alone (Glen 1972, Lane 1982)

The dog in this report was presented with a known history of oral stick injury making diagnosis easy. This is not the case in all pharyngeal stick injury victims. A dog may be presented with no history of trauma or stick injury (White and Lane 1988). Dogs that chew, carry or retrieve sticks are at a higher risk, and breed predisposition is seen in the medium to large dogs (collies, springer spaniels, labrador, German shepherd). Diagnosis may also be made difficult in a case under antibiotic and steroid therapy, as these delay abscess formation. The dog developed the abscess after antibiotic therapy was stopped.

Management of pharyngeal stick injuries is by radical exploration, curettage and drainage with removal of the foreign body. In some cases no foreign body is recovered even after an aggressive exploration (White and Lane 1988). This could be because the stick may have been removed by the owner or the veterinarian, yet leaving some very tiny fragments or just an innoculum of bacteria, which eventually leads to abscess formation.

Dogs that are suspected of stick injury should be examined thoroughly to rule out lacerations of the soft palate and oesophagus, and to remove any visible foreign bodies in both acute and chronic cases. Lacerations of the oesophagus need immediate repair as a delay will lead to mediastinitis and prognosis for such cases is guarded.

Radiography in two planes may assist in identifying and locating radiopaque foreign bodies making surgical approach easier. Many foreign bodies are not visible, therefore all tracts should be followed. Prognosis after radical exploration is excellent as long as all the foreign material and tracts have been removed.

In most referred cases the sinus will have been explored more than once without success (White and Lane 1988) as is the case in the labrador presented here. The reason being due to inadequate curettage of the sinuses, splinters left behind in the granulation tissue, and also lack of drainage post-operatively.

Aggressive exploration with curettage and flushing of the sinuses will usually lead to resolution of the clinical signs even if the foreign body has not been recovered. Unfortunately, some cases are reported to have persistent sinus discharge even after an aggressive exploration (White and Lane 1988).

The history, course of the disease and treatment failure of the labrador before being referred is consistent with those reported by White and Lane (1988). The dog responded favourably to radical exploration, curettage, excision of granulation tissue and removal of the foreign bodies. There was no report of recurrence of the swelling, pain or dysphagia.

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Appendix 1

Routine anaesthesia used in cases in Section II is described in more detail in this appendix.

Taking into consideration the age and size of the animals, dogs were premedicated with acetylpromazine (dog- 0.05mk/kg and cat- 0.05-0.1mg/kg) and pethidine (dog- 1-5mg/kg and cat- 1-3mg/kg), while cats were given atropine (0.1mg/kg) in addition. All the animals, unless stated otherwise, were induced with thiopentone (10ml/kg, 2.5%) or propofol (dog- 4mg/kg and cat- 6mg/kg). They were then intubated with an endotracheal tube. Maintenance was achieved with the use of an oxygen/halothane/nitrous oxide mixture via circuits appropriate to the animal's size, except in the case of the diaphragamtic rupture where nitrous oxide was omitted.

Nearly all animals were supported with intravenous fluids either crystalloids and/or colloids.

	Breed	Sex	Age	Orthopaedic Injury	Soft Tissue Injury
	CAT				
1	DSH	FN	8.00	# pelvis	none
2	DSH	F	2.00	# femur & humerus	none
3	DSH	F	1.00	none	Diaphragmatic rupture
4	DSH	MN	3.00	none	Diaphragmatic rupture
5	DSH	M	2.50	none	Ventral abdominal wall rupture
6	DSH	FN	2.00	# ribs	Diaphragmatic rupture
7	DSH	FN	1.50	none	Diaphragmatic rupture
8	DSH	MN	0.70	none	Diaphragmatic rupture & Degloving wound
9	DSH	F	2.50	none	Diaphragmatic rupture
10	DSH	FN	6.00	none	Diaphragmatic rupture
11	DSH	F	2.00	# humerus	none
12	DSH	M	2.60	# humerus	Pneumothorax & Pulmonary contusion
13	DSH	MN	4.00	# radius/ulna	Mouth laceration
14	DSH	FN	0.80	# femur & humerus	Limb skin bruising
15	DSH	MN	0.50	# humerus	none
16	DSH	MN	4.00	# femur	Pneumothorax

Appendix 2

	Breed	Sex	Age	Orthopaedic Injury	Soft Tissue Injury
17	DSH	FN	1.00	# femur	Pneumothorax
18	DSH	FN	1.00	# femur (bilateral)	none
19	Siamese	MN	1.50	# femur (bilateral)	none
20	DSH	MN	1.50	# femur & tibia/fibula	none
21	DSH	MN	6.00	# femur	none
22	DSH	FN	0.70	# pelvis & femur	none
23	DSH	FN	0.60	# pelvis & femur	none
24	DSH	FN	2.00	# pelvis & femur	none
25	DSH	M	2.00	# pelvis & femur	none
	DOG				
26	Cross	M	2.00	Hip dislocation	none
27	Cross	M	2.50	# skull	Eye proptosis
28	Cross	FN	0.60	none	Diaphragmatic rupture
29	Cross	M	5.00	none	Pneumothorax & Pulmonary contusion
30	Cross	F	0.50	# radius/ulna	Limb skin bruising
31	Cross	M	0.60	# radius/ulna	Mouth bleeding & lacerations
32	Cross	FN	4.00	# radius/ulna	Pulmonary contusion

Appendix 2

	Breed	Sex	Age	Orthopaedic Injury	Soft Tissue Injury
33	Cross	F	1.20	# humerus	none
34	Cross	FN	14.00	# tibia/fibula	none
35	Cross	F	0.40	# femur	none
36	Cross	F	10.10	# femur	none
37	Cross	M	0.50	# femur (bilateral)	Pulmonary contusion
38	Cross	M	5.00	# femur	none
39	Cross	M	6.00	# pelvis	none
40	Cross	M	8.00	# pelvis	none
41	Cross	M	2.30	# pelvis	none
42	Cross	F	2.00	# pelvis	none
43	Cross	M	0.60	# tibia/fibula	Limb skin lacerations
44	GSD	M	1.00	# pelvis & femur	none
45	GSD	F	4.00	none	Pneumothorax
46	GSD	F	0.50	# humerus & radius/ulna	Pneumothorax
47	GSD	F	0.70	# femur & tibia/fibula	Nasal bruising
48	GSD	M	4.00	# femur	Pneumothorax
49	GSD	M	3.00	# tibia/fibula	none

	Breed	Sex	Age	Orthopaedic Injury	Soft Tissue Injury
50	GSD	M	6.50	# pelvis	none
51	GSD	M	3.00	# skull	Ear, Nose bleeding
52	GSD	F	8.00	# tibia/fibula	none
53	GSD	M	3.50	# radius/ulna	none
54	GSD	F	4.50	# pelvis	none
55	GSD	M	0.50	# pelvis & femur	Ventral abdominal wall rupture
56	GSD	F	0.80	# pelvis & femur	none
57	Welsh spinger spaniel	F	0.60	# humerus	none
58	C.K.C.S.	M	0.40	none	Diaphragmatic rupture
59	Cocker spaniel	FN	2.50	# radius/ulna	none
60	Cocker spaniel	F	0.90	# femur	none
61	Cocker spaniel	M	7.00	# femur & elbow dislocation	Pneumothorax
62	Springer spaniel	M	0.40	# tibia/fibula	none
63	Cocker spaniel	M	0.50	# pelvis	none
64	Welsh springer spaniel	F	0.80	# pelvis & femur (bilateral)	none
65	Cocker spaniel	M	0.50	# pelvis	none
66	Border collie	F	10.40	# radius/ulna & elbow dislocation	none

Appendix 2

	Breed	Sex	Age	Orthopaedic Injury	Soft Tissue Injury
67	Border collie	M	1.00	# femur	none
68	Border collie	M	7.00	none	Diaphragmatic rupture
69	Border collie	M	7.00	# pelvis	none
70	Border collie	F	9.00	# pelvis	none
71	Border collie	M	5.00	# hock	none
72	Border collie	F	7.00	# tibia/fibula	none
73	Border collie	M	6.00	Hip dislocation	none
74	Labrador	M	1.00	# femur	none
75	Labrador	M	2.00	# 2nd cervical vertebra	none
76	Labrador	FN	12.50	# humerus & elbow dislocation	none
77	Labrador	F	0.60	# metatarsus	Limb skin bruising
78	Labrador	M	0.70	# pelvis	none
79	Staffordshire bull terrier	M	0.50	# pelvis & femur	Limb skin and Nasal bruising
80	Staffordshire bull terrier	M	0.50	# femur & tibia/fibula	none
81	Yorkshire terrier	M	3.00	none	Diaphragmatic rupture
82	Kerry blue terrier	F	4.00	none	Diaphragmatic rupture
83	Yorkshire terrier	M	0.70	Elbow dislocation	Limb skin bruising

Appendix 2

	Breed	Sex	Age	Orthopaedic Injury	Soft Tissue Injury
84	Jack Russell terrier	M	2.00	# scapula	none
85	Jack Russell terrier	M	0.50	# pelvis & femur	none
86	Jack Russell terrier	M	0.50	# pelvis	none
87	Jack Russell terrier	F	0.60	# pelvic & femur (bilateral)	none
88	Rottweiler	FN	3.00	# radius/ulna	none
89	Rottweiler	M	0.70	# femur	Limb skin bruising
90	Rottweiler	F	0.80	# femur	Degloving wound
91	Rottweiler	M	0.40	# femur	none
92	Irish setter	F	5.00	Hip dislocation	Pneumothorax
93	Irish setter	F	0.60	# pelvis	none
94	Irish setter	M	1.50	# pelvis	none
95	Doberman	M	2.00	# humerus	none
96	Doberman	M	4.00	# radius/ulna	none
97	Dachshund	F	1.50	none	Diaphragmatic rupture
98	Deerhound	M	3.00	# pelvis	none
99	Corgi	F	2.00	Hip dislocation & # tibia/fibula	none
100	Hungarian viszla	F	9.00	none	Diaphragmatic rupture

Appendix 2

	Breed	Sex	Age	Orthopaedic Injury	Soft Tissue Injury
101	Miniature Pinscher	F	0.50	# pelvis & femur	Limb skin bruising
102	Poodle	M	5.50	# pelvis	none
103	Shitzu	M	1.00	Hip dislocation & # tibia/fibula	none
				# phalanx & I/P subluxation	
104	Weimaraner	M	1.00	# radius/ulna & elbow dislocation	none
			years		

#	= fracture	MN = male neutered	
I/P	= interphalangeal	M = male	
DSH	= Domestic Short Hair	FN = female neutered	
GSD	= German shephard	F = female	
CKCS	= Cavalier King Charles spaniel		