Disorders of the reproductive tract

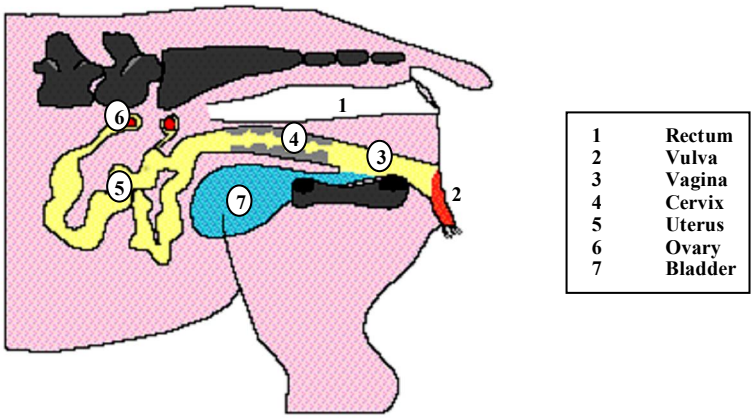
Diseases present in	Australia	Europe/Asia	North America
Anatomy of the reproductive tract			
Abortion in the pig	Yes	Yes	Yes
Aujeszkyôs disease (Pseudorabies)	No	Yes	No commercial
Brucellosis	No	Yes	Yes
Common developmental abnormalities	Yes	Yes	Yes
Farrowing complications	Yes	Yes	Yes
Leptospirosis	Yes	Yes	Yes
Milk production and suckling problems	Yes	Yes	Yes
Mycotoxins	Yes	Yes	Yes
Pregnancy diagnosis			
Parvovirus	Yes	Yes	Yes
Rectal and vaginal prolapses	Yes	Yes	Yes
Return to oestrus analysis	Yes	Yes	Yes
Stillborn and mummified piglets	Yes	Yes	Yes
Swine Fever ï see the Diseases of the skin	No	Yes	No
Swine Influenza ï see the Diseases of the chest	No	Yes	Yes
Tumours of the pig	Yes	Yes	Yes
14-21 days post-service vulval discharges	Yes	Yes	Yes

Surgery of the reproductive tract

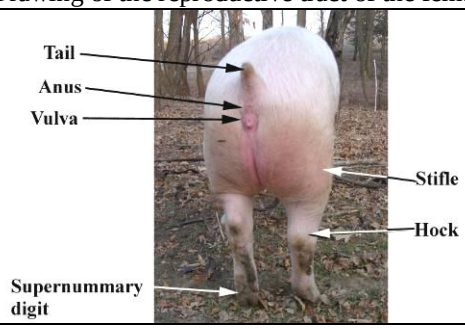
- General introduction
- Castration in the piglet
- Castration in the adult male
- Vasectomy
- Epididectomy
- Preputial diverticulum ablation
- Ovariohysterectomy
- Ceasarian section

Clinical Anatomy of the Reproductive Tract

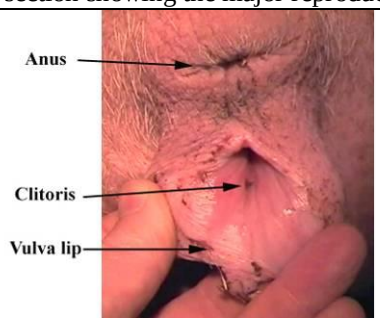
Female



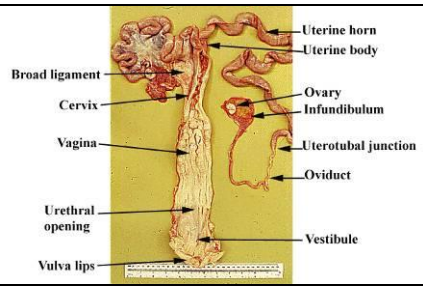
Drawing of the reproductive tract of the female Cross section showing the major reproductive organs.



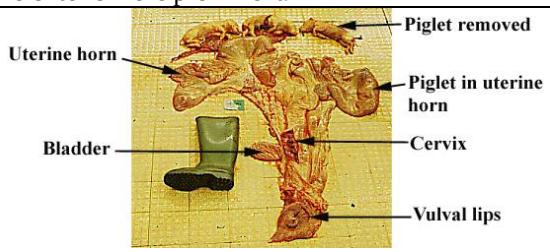
Caudal view of a female pig. Note the pig has been docked



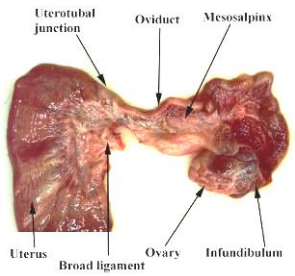
Detail of the open vulva. Note the position of the clitoris. This particular female is in oestrus making the clitoris more prominent.



The non pregnant female reproductive tract
Note the length of the uterine horns and oviduct

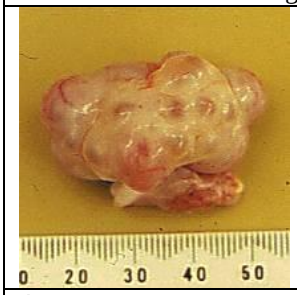


The female reproductive tract at parturition.
The pig died during parturition associated with retained piglets. Note that the uterine horns can exceed 2 metres in length



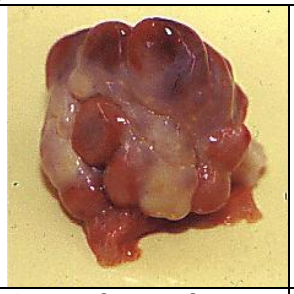
Detail of the uterotubal junction

Ovaries Gross changes during the reproductive cycle



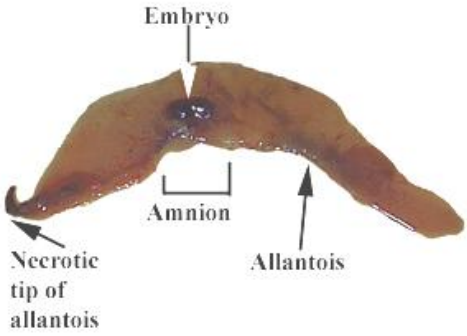
Anoestrus
Numerous small clear follicles less than 1 cm in diameter

Follicles
Clear follicles 1 cm in diameter prior to ovulation



Corpora haemorrhagica
Collapsed and ruptured follicles filling with a blood clot

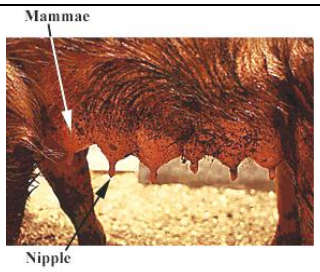
Corpora lutea
White hard copora 1 cm in diameter



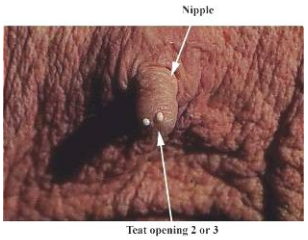
Note the necrotic tip of the allantois which may help to reduce intrauterine spread of pathogens. The allantois can stretch up to 1 metre in length.

The foetal membranes around 20 days of gestation

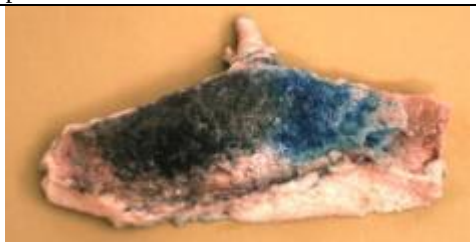
None lactating mammary glands. Gilt should have a minimum of 7 paired teats. Sow shown is 1 week pre-farrow ï note nipples are enlarged.



The lactating mammary glands lateral view
It is not unusual to have none glands. It is essential for piglet survival that the mammary glands are full. Note the size of the nipples when selecting sows a potential nurse animals

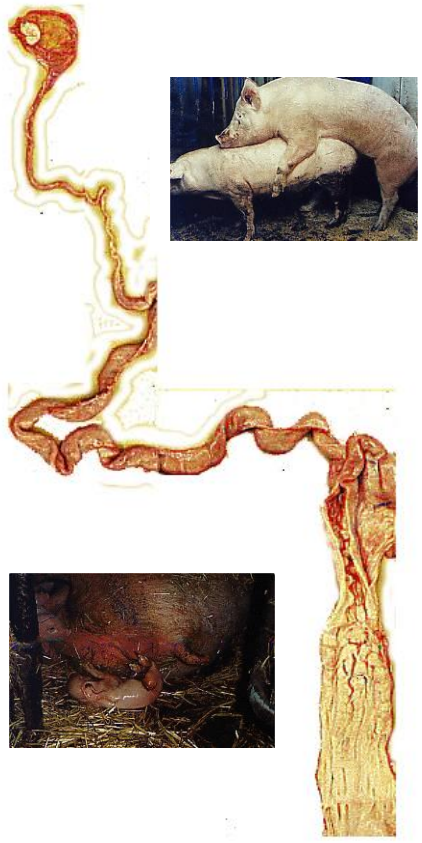


Detail of the nipple and one mammae
Milk has been expressed to demonstrate the location of the teat openings.



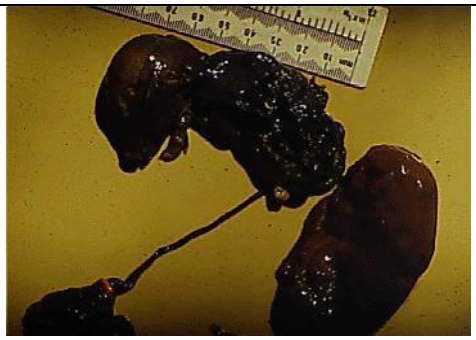
Cross section of the mammary gland, with ink injected post-mortem to delineate each of the two mammary glands supplying the common nipple. The anterior glands may have 3 mammary glands supplying the one common nipple.

Pregnancy in the pig

Day	Event	
- 1	Coitus	
0.5-1	Ovulation	
	Capture of eggs	
	Descent through oviduct	
	Fertilization	
2-3	Decent into uterus	
3- 14	Free migration of embryo through both horns	
7	Hatching	
10	Blastocyst produces oestrogens	
7-14	Placental elongation to 1 metre	
14-28	Implantation ï min 2 per horn	
14-17	Release of oestrogens by implanted embryos	
24	Organogenesis complete	
35	Bone present in foetus	
70	Immunocomplement	
105	Foetal corticosteroids	
115	Parturition	

Estimation of embryonic age

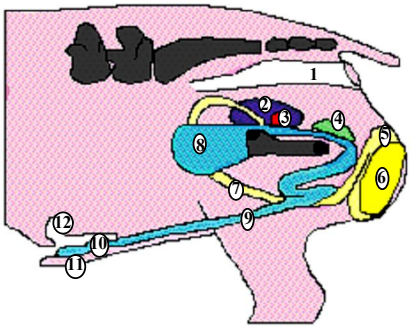
Crown Rump mm	Days of pregnancy
20	30
50	40
88	50
130	60
167	70
200	80
232	90
264	100
290	110



Crown-Rump = 80 mm ∴age ~ 48 days

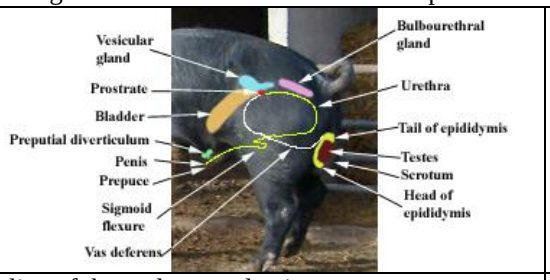
Easy calculator [(Crown-Rump length mm)/3] + 21 = age of foetus in days

Male reproduction

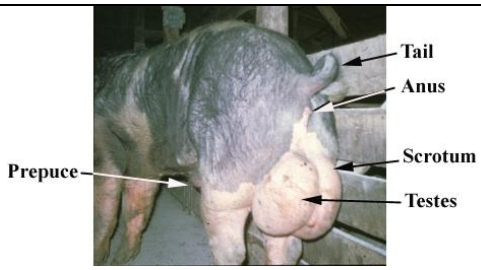


1	Rectum
2	Seminal vesicle
3	Prostrate
4	Bulbourethral gland
5	Epididymis
6	Testes
7	Vas Deferens
8	Bladder
9	Urethra
10	Penis
11	Prepuce
12	Preputial diverticulum

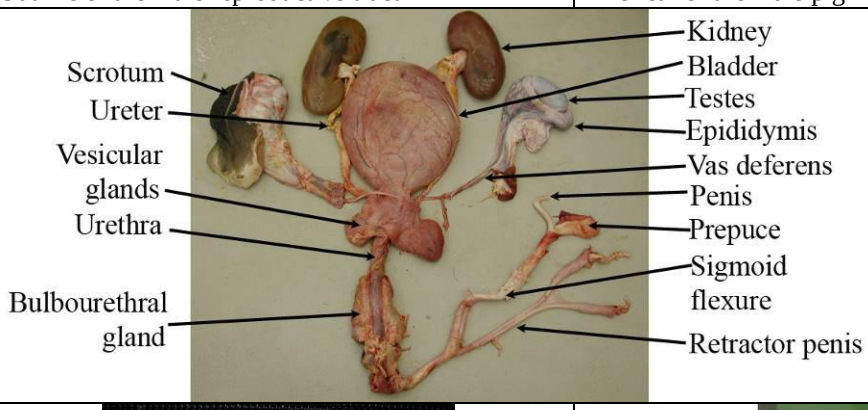
Drawing of the cross section of the male reproductive tract



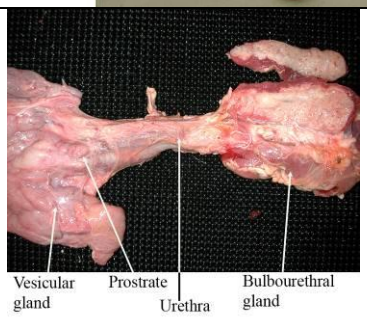
Outline of the male reproductive tract



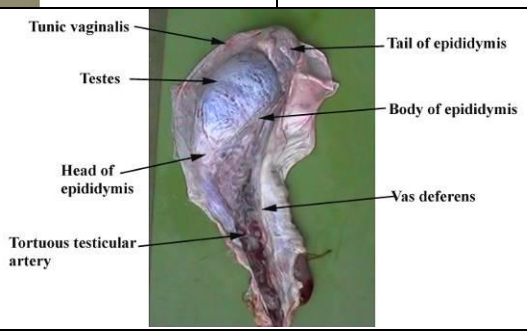
The rear of the male pig



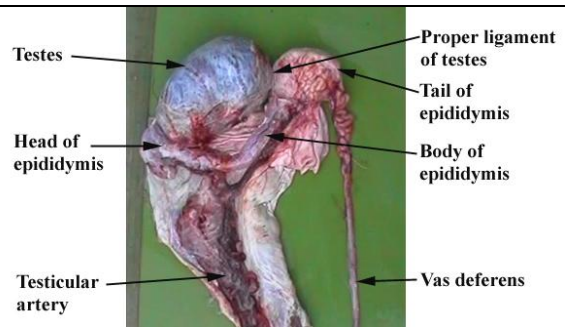
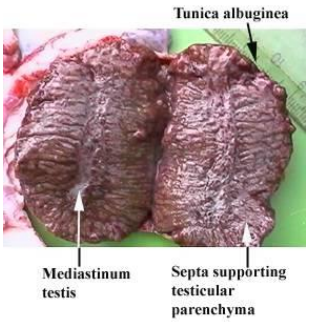
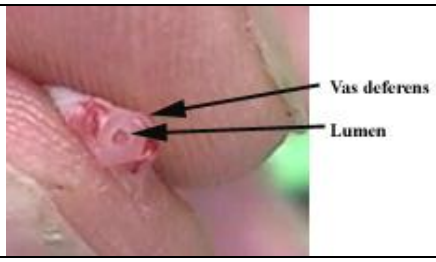
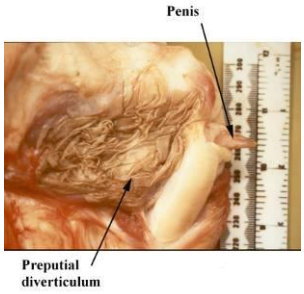
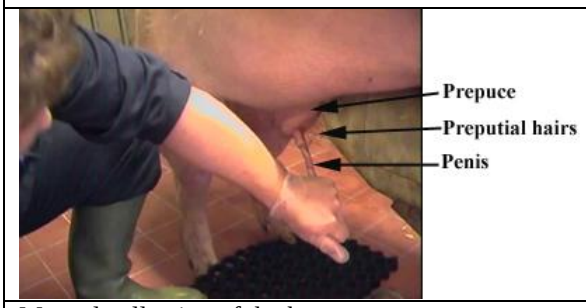
The male reproductive tract dissected and labeled.



The male sex glands
The prostrate produces seminal fluids
The vesicular glands produce sugars
The bulbourethral gland produces gel



Detail of the medial view of the left testes

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Detail of the medial view of the left testes</td><td>Cut surface of the sagittal section of the testes</td></tr>
<tr><td> 
</td><td>Review semen morphology ï see section in the clinical examination of the pig</td></tr>
<tr><td>Detail of a cross-section of the vas deferens</td><td></td></tr>
<tr><td>  </td><td> 
</td></tr>
<tr><td>The preputial os</td><td>The preputial diverticulum opened on the ventral surface</td></tr>
<tr><td> 
</td><td>  </td></tr>
<tr><td>Manual collection of the boar</td><td>Detail of the boar penis</td></tr>
<tr><td colspan="2">  </td></tr>
<tr><td colspan="2">Mammary glands in the male ï ideally select boars with 3 or more teats in front of the prepuce as this characteristic is linked to future litter size.</td></tr>
</table>

ABORTION IN THE PIG

There are a range of causes of abortion in the pig. Majority of abortions are non-infectious and some 90% are not diagnosed. It is also normal for 1.5% of all services to fail to farrow due to abortion. Abortion can occur at any time of pregnancy after day 11 until day 112. However, it should be noted that the loss of embryos around day 20 without the loss of the corpus lutea will not result in abortion; the sow will enter a period of pseudopregnancy and recycle after day 63 post-mating.

Non infectious causes:

Seasonal Effects

70% of all abortions fall into this category. Remember it is normal for sows to farrow in the spring, and therefore, there is a natural tendency for pregnancies to be lost in the summer and autumn. There are many factors believed to be involved in the summer infertility/autumn abortion syndrome ï variable daily temperatures, reduction in light length, effect of heat, loss of appetite in the summer

Environmental abortions

Sows may be subjected to stress factors relating to their environment: draughts, excessive heat stress, inadequate cooling, change in the feeding routines, changes in stockpeople, bullying when introduced into a new group and trauma from moving through narrow doorways. All of these factors singly or combined can result in abortion in the individual sow. Injections can also result in abortions ï particularly associated with some vaccines

Provide adequate cooling and mud as a ñsun creamò

Broken window resulting in draughts

Fighting in sows can lead to abortions

Mycotoxins

Although difficult to prove, mycotoxins have long been suspected as being responsible for abortions. In any case of 2 or 3 abortions over a short period of time, clean out the feed bins and feed lines. Never feed mouldy feed to animals. Mouldy straw can also play a significant role in the causes of abortion

Never feed mouldy feed to pigs.
Ensure good feeder hygiene at all times

Check straw for excessive mould

Regularly clean and check feed lines

Infectious causes

There are a range of infectious causes of abortion. Disease agents can cause abortion through one of two major routes:

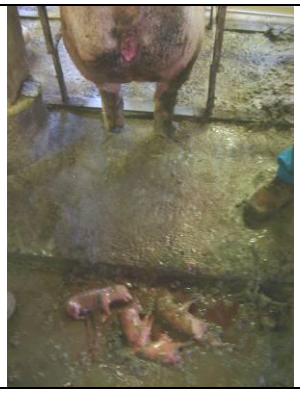
a) luteolysis ï generally through a high temperature releasing endogenous prostaglandins
b) Killing the piglet/placentitis

Examples of diseases that cause luteolysis include swine influenza, erysipelas or Classical swine fever.
Diseases that kill piglets would include Aujeszkyôs Disease or Japanese Encephalitis Virus.
How diseases such as Leptospirosis cause abortion is still unclear.

Aborted foetuses

Porcine Reproductive and Respiratory Syndrome virus

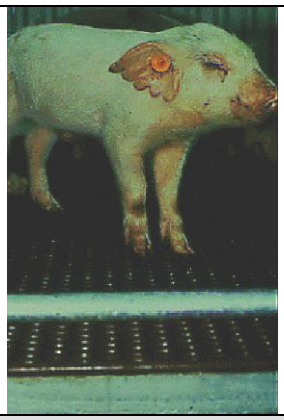
PRRSv can be responsible for severe abortion storms when a new stain enters a naive population of pregnant sows. PCR and sequencing can help identify the source of the new strain.
Note however, not all abortion storms on PRRSv positive farms are associated with PRRSv.



AUJESZKY'S DISEASE PSEUDORABIES

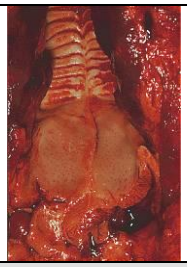
Other names	Pseudorabies. PRV. ADV. Suid herpesvirus (SHVI). Aujeszkyôs Disease
Causal agent	Virus. Herpes DNA virus. Enveloped
Age group	All age groups
	The disease is notifiable and a class B disease OIE. Several countries are free of Aujeszkyôs Disease.
Clinical signs	
Naive herds	
Neonatal pigs	Present with a range of severe central nervous signs from fitting to severe incoordination. The piglets may present as sitting like a dog due to posterior paralysis. Mortality is high
Weaned pigs	Central nervous signs may be reduced and an increase in respiratory signs
	Respiratory diseases often associated with secondary infections
	Animals can waste and suffer ill thrift and are often stunted
Growing pigs	The CNS signs reduce and the respiratory signs increase. The degree of respiratory disease depends on secondary infections
Adults	Reproductive signs predominate. Sows may abort and animals infected close to term give birth to stillborn or weak piglets
On established herds	May be few clinical signs
In other species	The pig is the natural host for Aujeszkyôs Disease
	In other animals the disease either causes no problems or is invariably fatal
	In cats, rats and mice the disease kills rapidly and this can be important in diagnosis
	Dogs present with a rabid signs, hence Pseudorabies
	Cattle and sheep and rarely horses present with a mad-itch
	Aujeszkyôs Disease does not affect man

Dead finishing pigs from an acute Aujeszkyôs Disease outbreak



Weaned pig showing signs of severe depression. The animal also presented with pneumonia and head pressing

Infectivity	
	Transmission within a herd is nose to nose, through mating both natural and AI and transplacental
	The virus can survive short periods in the air, up to 7 hours with the RH higher than 55%
	The virus is rapidly inactivated when exposed to drying
	Infection of wild animals also help to spread the disease
	The disease can spread up to 2 km by air under the correct conditions
	Transmission can occur between trucks in transport and tailgating of trucks should be avoided. Also parking next to other pig trucks at service stations
Incubation period	2 to 4 days

Post-mortem Lesions	
	Gross lesions are often absent or minimal
	A serous to fibrinous rhinitis is common and a necrotic tonsillitis. This does require detailed examination of the head
	Respiratory lesions of complicated pneumonia often present
	The liver and spleen typically have yellow-white necrotic foci (2-3 mm)
	A necrotic placentitis and endometritis may be observed. In aborted piglets there may be necrotic lesions in the lungs, liver, spleen and tonsils
Post-mortem findings	 Normal tonsils at the back of the pigs mouth  Necrotic debris in the nasal passageways and tonsils in a pig with Pseudorabies
Diagnosis	
	Clinical signs and virus isolation
	Serology is of limited use in acute cases as it can take 7-10 days to produce antibodies
	Diagnosis confused by maternal antibodies which may persist for up to 4 months
	Differential serology may be used to differentiate vaccinated from field infected pigs
Treatment	
	None
Prevention	Vaccination. Uses of a variety of modified live vaccines have been developed. The vaccine reduces shedding and latency, but does not remove it.
	Vaccines have been made from genetically modified virus. These viruses have a variety of nonessential proteins missing from their genome
	In Northern Ireland, the vaccine uses a g1 deleted vaccine strain. In other countries gIII, gX and gp63 have been used. It is important not to mix vaccine strains as they can recombine. The gX vaccine helped eliminate the disease in the USA.
Control	Good biosecurity. Purchase only from Aujeszkyôs Diseases Free Herds.
Eradication	Vaccination and elimination leads to Aujeszkyôs Diseases free farms and areas
	Depopulation followed by 30 day no pigs is recommended
	Countrywide eradication programmes are successful but very expensive.
Common differentials	
	Streptococcal diseases can produce similar necrotic lesions in the liver and spleen. Other causes of neurological, respiratory and reproductive diseases.
Zoonotic	
	None

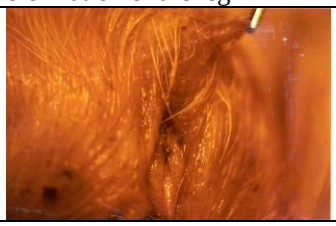
BRUCELLOSIS IN PIGS

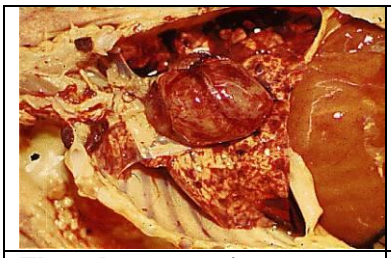
Causal agent	*Brucella suis* biovars 1, 2 and 3. Biovar 4 occurs in Reindeer and Caribou, whereas Biovar 5 is in mice. Brucella is a bacteria	
Age group	All ages can be infected	
Clinical signs		
	Generally no clinical signs exhibited by infected animals	 *Brucellosis suis* in a testes
Sows	Can cause abortion, infertility and severe metritis	
Boars	Can cause orchitis (infection of testes) and infertility	
Piglets, Weaners	Posterior paralysis and lameness	
Infectivity		
	The major route of infectivity is through contact with another pig. Venereal transmission is possible. Note many other mammals (wild and domestic) can carry and potentially transmit *Brucella suis* to pigs. In Europe *B. suis* biovar 2 occurs in the Hare	
Post-mortem Lesions		
	Generally none. May be abscessation sometime with necrotic foci in the liver. Metritis and orchitis	
Diagnosis		
	Serological examination. This has been a requirement for exporting pigs around Europe, but is now not required. The UK is free of *Brucella suis* but it is endemic in the wild boars of Europe.	
	Note the relatively common organism *Yersinia enterocolitica* O: 9 share a common antigen and this will cause false positive results.	
Treatment		
Individual	None	
	This is a reportable disease. Depopulation is the only viable option	
Control	Through good national and herd biosecurity measures	
Zoonotic implications		
	Brucella is a serious zoonotic disease and causes ‘undulating fever’ in man. This however, is primarily an occupational hazard. Note *Yersinia enterocolitica* is also a zoonotic disease causing diarrhoea	

COMMON DEVELOPMENTAL / CONGENITAL ABNORMALITIES

Condition	Level	Possible Cause	Comments
Arthrogryposis	0.2	Hereditary	Destroy piglets
Atresia ani	0.4	Hereditary	Low heritability Environmental influences
Bent legs		Unknown	Possibly exposure mid pregnancy to toxic agents
		Hereditary	Auto recessive gene.
		Poisons	Hemlock Black cherry
		Vitamin A	Excess dietary levels or by injection
Cleft palate	0.2	Hereditary	Destroy piglets
Congenital tremor		Classical Swine fever virus	Type AI
		Unidentified virus	Type AII
		Sex linked in male Landrace	Type AIII
		Recessive gene in the Saddleback	Type AIV
		Trichlorvon or Neguvon poisoning	Type AV
		Aujeszky's virus	Demonstration of virus
		Organophosphorus poisoning	Overdosing
Dwarfism		Hereditary	Rare
Epitheliogenesis imperfecta		Hereditary	Destroy if large
Haemaphrodite		Hereditary	Low levels
Inguinal hernia	1.5	Hereditary	Method unknown Environmental influences
Inverted teats	20	Hereditary	Ensure good teat selection in boars and gilts
Kinky tail	1.5	Hereditary	Common
Lymphosarcoma		Hereditary	Seen in young adults
Malignant hypothermia		Hereditary	Associated with lean genes
Meningocoele		Hereditary	Low incidence
Naval bleeding		Unknown	Associated with shavings
Pietrain creeper syndrome		Hereditary	Uncommon
Pityriasis rosea	1	Hereditary Landrace	Common ï resolves without treatment
Porcine stress syndrome (PSS)		Hereditary	DNA test and eliminate
Thrombocytopaenic purpura	1	Antibody antigen reaction	Quite common
Splay leg	1.8	Hereditary	Common in the Landrace
		Fusarium toxin	Mouldy feeds
		Environmental	Slippery floors, chilling of piglets
Umbilical hernia	1.5	Hereditary	Environmental influences Navel tearing

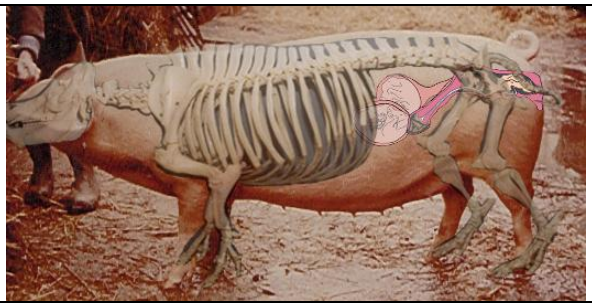
Pictures of some of these conditions

	 	
Arthrogryposis A soft tissue defect causing contraction of joints	**Atresia ani** The anus is missing. Females can survive creating a cloaca. Males die.	**Bent legs** The abnormality occurs in the bone skeleton causing deformation of the leg
		
Cleft palate A range of conditions with defect of both the hard and soft palate. The piglets cannot drink properly and die	**Epitheliogensis impectecta** A full skin thickness defect of the skin present at birth. Some cases are able to survive to finish with scaring	**Haemaphrodite** The pig has both male and female reproductive organs, a range of abnormalities classically enlarge clitoris
		
Inguinal hernia Failure of inguinal ring and presence of intestinal contents in inguinal region. Be careful at castration	**Inverted teats** The teat can be manipulated out of the mammary gland but will invert again, piglets cannot suckle	**Kinky tail**
		
Lymphosarcoma Picture shows lymphosarcoma on inside of rib cage. Generally seen in young adults to 16 months	**Meningocoele** Defect of the cranium resulting in a prolapse of the meninges under the skin, generally fatal	**Pityriasis rosea** Skin disorder seen in 30 to 60kg pigs, while quite dramatic, the pig is not sick and spontaneously recovers.

		
Thrombocytopaenia purpura Autoimmune problem the colostral antibodies attach the piglet resulting in generalised haemorrhage	**Splayleg** Defect of the development of the lumbar muscles. Management can assist these pigs. Improve floor footing	**Umbilical hernia** Defect of the body wall in the umbilical region. If larger than 30 cm circumference destroy the pig
		
General facial abnormalities ï three shown		
A range of other abnormalities including inversion of abdominal contents, specific organ defects are all recognised but the genetic or specific cause has not been recognised.		
		
General multiple abnormalities	Defect of the kidneys ï horseshoe kidneys	Muscle defect ï full of fluid
		
Limb defects	Blocky legs	Missing tibia
		
Missing limbs	Congenital porphyria (left)	Toe defects

PIGLET PRESENTATIONS AT FARROWING

Piglets may present in a variety of positions at the point of farrowing. Most of the time, the piglet can still be born without assistance, but the following drawing may help a stockperson understand what their fingers are telling them when manual assistance is deemed necessary.

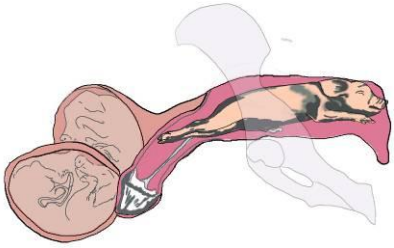


A sow or gilt which presents with a farrowing problem should already be in the farrowing area. If standing encourage the female to lie down by rubbing her udder line. It is very dangerous to attempt to farrow a sow while standing, especially if there is a rear bar on the crate.

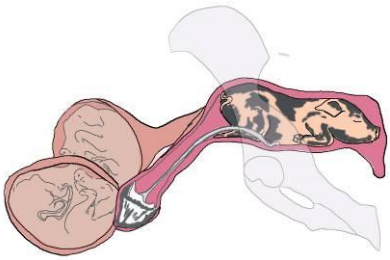
Wash your hands carefully. Ensure your finger nails are short. Dry your hands. Place an arm length glove over each hand.

It is sometimes easier to try and learn to be able to use either hand to assist farrowing. Ensure you apply plenty of lubricant to your hand and arm.

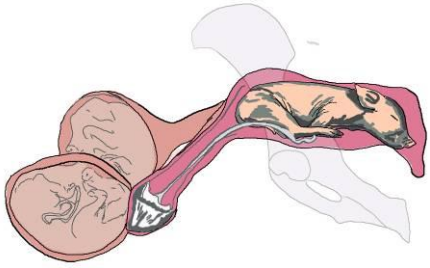
Place extra lubricant in to the palm of your hand. Bring your fingers together and carefully enter the vulva lips and start exploring the vulva and vagina.



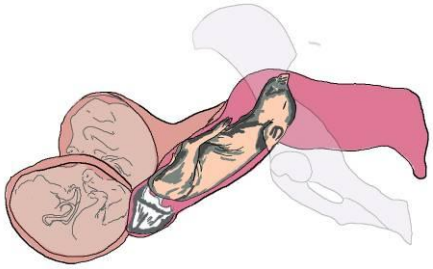
Normal (ideal) presentation.
If piglet slightly oversized, place rope on both front feet and assist farrowing



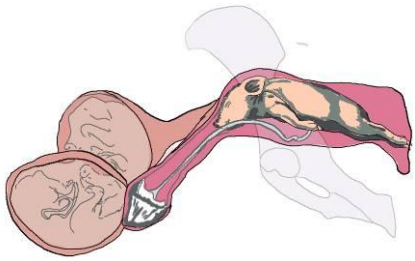
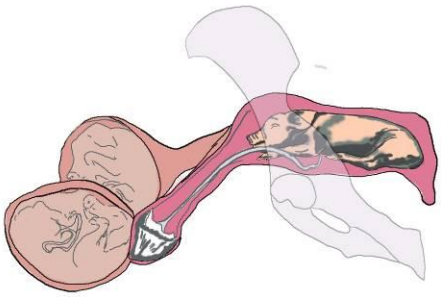
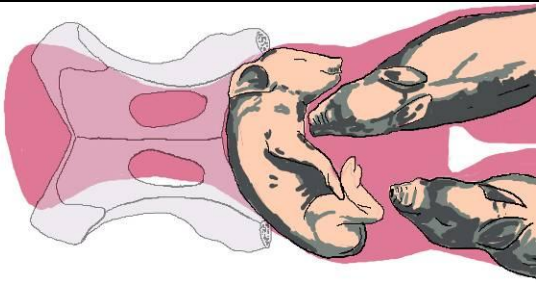
Front legs back ï retrieve front legs pull forward and remove piglet.



Forward but front feet back, possibly hind feet forward. Push piglet back into pelvis and pull front



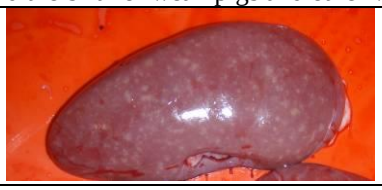
Piglet upside down. May be possibly to pull front feet forward and by applying head rope and rope of

feet forward. Place head rope onto head and rope onto front feet and remove piglet. If still difficult, may be necessary to push hind feet backwards before pulling on piglet.	feet, pull piglet out. If still difficult, will be necessary to rotate piglet. Note, if the piglet is alive, by pressing on the eye sockets will make piglet wriggle and turn.
	
Backwards with back feet backwards. Place rope around back feet and remove piglet. If piglet is difficult check shoulder position, may be necessary to manipulate front legs into forward position.	Breech. Hook onto back hocks and manipulate legs backwards until feet visible. Do the second foot. Apply ropes to the feet and remove piglet
	
Most difficult position. Push piglet back into uterine body and bring head forward. Place head rope onto piglet. Retrieve legs and place rope on legs and remove piglets. Often other pigs will rapidly follow, several may be stillborn.	Placement of head rope. Note rope goes behind both ears and looped into mouth. It is then tightened against the mouth. Thus with gentle traction varying between legs and head, the piglet can be eased through the pelvis.
It should not be necessary be break sweat when farrowing a sow. Consider patience and use of oxytocin. Do not overreach into the sow to retrieve every piglet you can feel, give nature a chance.	

LEPTOSPIROSIS

Other names	In man infection with *L. icterohaemorrhagica* is called Weil's Disease
Causal agent	A very large family of bacteria present in all parts of the world. They belong to the spirochaete type of bacteria There are five serovars and groups which are important to the pig: Pomona, Australis (Bratislava) and Tarassovi together with Canicola, Icterohaemorrhagica and Grippotyphosa
L. pomona	The most clinically important Leptospirosis is *L. pomona*. However, *L. pomona* is not present in all countries.
Age group	Mainly the adults are affected with clinical signs. Note that non pig specific leptospira can infect any age group. For example jaundice associated with *L. icterohaemorrhagica* can affect weaners as well as adults
Clinical signs	
Acute	Anorexia, pyrexia and listlessness. Therefore very non-specific and tends to only affect individuals, on majority of farms these signs are missed.
	With *L. icterohaemorrhagica* the animals can be very ill and jaundiced
Chronic	Abortions, stillbirths and the birth of weak pigs and other vague reproductive problems

Aborted piglets but note there are many causes of abortion in the pig



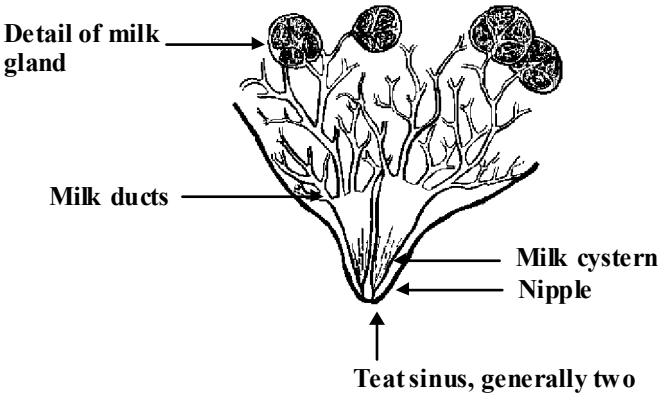
Interstitial nephritis ï commonly associated the *L. pomona*

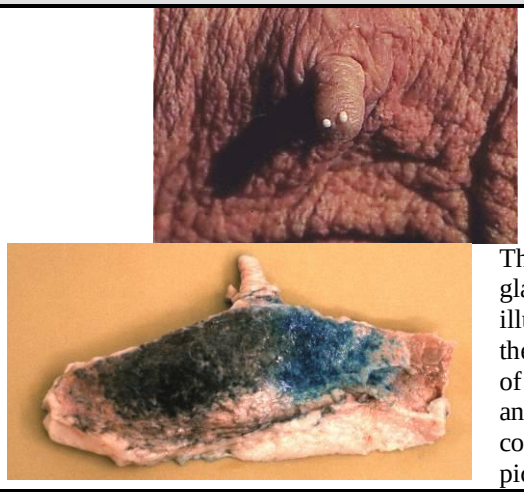
Normal and jaundiced pig ï yellow.

Infectivity	
	The organism cannot withstand drying, but will live for a long time in wet conditions. Rodents can carry many leptospiral diseases
Post-mortem Lesions	
Acute cases	The pathological findings can be very limited
Chronic	Mainly confined to the kidneys and consist of scattered small grey foci of a focal interstitial nephritis. Note many other diseases can cause identical findings and leptospira can be isolated from kidneys with no pathological damage
Diagnosis	
	Can be difficult
Serology	Antibody positive titres can be very transient, lasting less than a month. Many serological tests are inconclusive at 1/100
Demonstration	The demonstration of Leptospiras in tissues can be achieved but is not easy. Silver stains.
Culture	Difficult and time consuming. Leptospira are also normal in healthy animals
Treatment	
Individuals	Streptomycin at 25mg/kg is effective. This may be compulsory to boars entering studs.
Group	In-feed medication with 800g of chlortetracycline per tonne of feed for 6 weeks.
Vaccines	Vaccine only protective for 3 months. Vaccines are not available in all countries.
Control	Rodent control and biosecurity
	Manage wallows to allow them to dry out during the summer. Disinfect water supplies
	Routine treatment of boars especially at AI studs
Common differentials	
	Other reproductive problems. Poor stockmanship and breeding routines
Zoonotic	Various leptospiral species cause problems in humans. Some are potentially fatal

MILK PRODUCTION AND SUCKLING PATTERN

Anatomy of the Udder





The two glands are illustrated by the two drops of milk above and the two colours side picture

Hormonal Control of Lactation

The two major hormones of lactation are Prolactin (production) and Oxytocin (release) both can be stopped by stressors and toxins such as LPS from bacteria such as *E. coli*.

Normal suckling pattern	Once an hour for 20 seconds. In outdoor sows by day 18 suckling has reduced to every 2 hours, this is not seen in crated sows.
Colostrum	Produced for 5 days. Absorption through piglets stomach only within the first 12 hours (ideally 6 hours)
Milk	Modern sows can produce 12 litres of milk at peak lactation.

Factors than can affect colostrum and milk intake

1	No milk let down	Nervous or stressed sow. Defect of the udder Blind or inverted teat. Ergot poisoning.
2	Draughts	Chilling reduces colostrum intake. Chilling reduces swallowed colostrum uptake by the stomach
3	Teat design	Teat too large for pigletôs mouth. Blind teats Non functioning teats
4	Too many piglets	Inadequate cross-fostering
5	Weak piglets	Disease i.e. PRRSv, Parvo etc. Cold, wet piglets
6	Number of teats	Inadequate for the number of piglets
7	Birth order	A 10% difference in colostrum availability can occur between the first and last piglet, particularly if farrowing takes a long time
8	Disease of the sow	Mastitis Constipation Metritis Mycotoxins
9	Gestation overfeeding	Udder oedema
10	Crate design	Udder and nipple access restricted by crate design.
11	Sow feeding curve	No adherence to a feeding curve results in inadequate milk production. Temperature of the farrowing house. Inadequate water supply restricts milk production.
12	Chronic mastitis	Associated with flies, rough surfaces in the farrowing house or damage of the teat and udder by the sow's feet.

DISORDERS OF THE MAMMARY GLAND

Acute Mastitis

Acute mastitis is primarily associated with *E. coli* but also staphylococcus and/or streptococci. Accurate diagnosis of the causal agent is complicated by the difficulty in obtaining a suitable sample to investigate. Note only one mammae within the gland may be diseased.

Clinical signs:

Sow is obviously ill and probably toxic. She may have discoloured ears. The udder is hard and reddened particularly in the area infected. She has a temperature of 40-42C

Treatment:

1 Inject the sow with oxytocin 10 IU
2 Inject antibiotics as prescribed by the vet
3 If the sow is toxic none steroidal anti-inflammatory agents may be helpful
4 Ensure excellent hygiene of the udder line
5 Provide artificial milk replacement for the piglets. However, initially leave the piglets on the sow to help remove the infected milk and to give her a will to live
6 Provide the sow with excellent water supplies and consider providing some fresh food

Control:

1. Review farrowing house hygiene practices especially the water supply
2. Review teeth clipping
3. Review fly controls
4. Cull infected sows if a herd problem exists

Chronic mastitis

Chronic mastitis is associated with a range of bacteria such as Staphylococcus, Streptococcus, *Arcanobacterium pyogenes* and *Actinobacillus suis.* The sow presents with large often multiple lumps in the mammary gland, classically first seen at the end of lactation or in the newly weaned sow. The sow will generally show no other clinical signs. The infected gland will be non functional. Once observed, there is no effective treatment. Review the number of remaining functional teats and programme the sow to enter the cull pool

Udder oedema

Udder oedema is seen in sows and gilts. This may even be recognised in the dry/gestating sow 20 days prior to farrowing.

Clinical signs:

There is a buildup of fluids in the mammary gland with little or no milk let down
The sow shows some discomfort with the glands, which may be large enough to interfere with locomotion
Piglets attempting to use the affected teats will not thrive and may require fostering
Palpation of the gland will reveal oedema that when a thumb is pressed into the udder, the depression will take a long time to disappear.

Predisposing factors:

Majority of udder oedema causes are associated with overweight sows that receive too high a feed plane while pregnant. This is particularly so at the end of pregnancy.

Treatment:

<u>Individual:</u> Can be difficult. Inject with oxytocin 5iu every 4 to 6 hours Provide milk replacer for the piglets

Control:

Review feeding practices in the later stages of pregnancy and condition score the sows.
Ensure the water supplies are excellent. Avoid constipation by providing more fibre before farrowing

Mycotoxicosis – Ergot poisoning

Ergot (*Claviceps purpurea*) poisoning results in an immature udder ï of about 110 days of gestation. Ergotamine interferes with prolactin production. Sows present with a flaccid udder and milk production is sparse and non responsive to oxytocin. Ergot tends to occur on small grains ï wheat for example. Circulation problems and end arterial thrombi occur in finishing pigs

Teat injuries

Teat damage
Teats can be damaged by piglet teeth. However, teeth clipping is not required to stop damage to the mammary glands. Ensuring the sow produces plenty of milk will reduce or eliminate the damage.

Particularly the hind teats can be damaged by the hind legs and slats.

Teat necrosis
All new born piglets are born with swollen naturally enlarged teats (and vulvas) associated with maternal oestrogen production during the later stages of parturition. If the piglets rub their teats on rough flooring, teat necrosis occurs. This damage can result in poor mammary development.

Supernumerary teats
These can occur sporadically. They should be avoided in replacement breeding stock.

MYCOTOXICOSIS

Mycotoxin	Source	Toxic level	Effect
Aflatoxin	*Aspergillus flavus* *Aspergillus parasiticus*	>0.2 ppm	Hepatitis. Reduced growth Reduced feed intake Immunosuppression
Deoxynivalenol DON Vomitoxin	Fusaria	>5 ppm	Reduced feed consumption
Ergot	*Claviceps purpurea*	>1000 ppm	Reduced feed intake Agalactia Gangrene
Fumonisins	*Fusarium moniliforme* *Fusarium proliferatum*	>25 ppm	Liver dysfunction Pulmonary oedema
Ochratoxin Citrinin	*Aspergillus ochraceus* *Penicillium viridicatum* *Penicillin citrinum*	>0.2 ppm	Renal lesions Immunosuppression
Tichothecenes T-2 Toxin DAS	Fusaria	>3 ppm	Decreased feed intake Immuosuppression
Zearalenone	*Fusarium graminearum*	>1 ppm	Oestrogenic Pseudopregnancy Enlarged vulva weaners
Plant toxins ï there are numerous possibilities in poisonous plants			
Gossypol	Cottonseed	>200 ppm	Reduced feed intake

1 ppm = 1 mg/kg 1 ppb = 0.001 mg/kg or 1 µg/kg

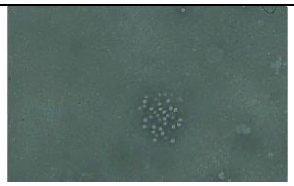
Examples of some mycotoxins

Ergot (arrowed)

Fusarium on maize ï Zearalenone 10 ppm

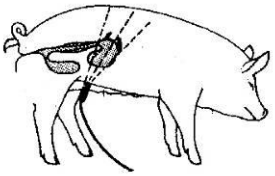
Feed contaminated with cottonseed ï gossypol

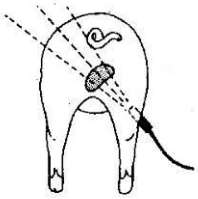
PARVOVIRUS

Other names	PPV
Causal Agent	Virus. A very small DNA non enveloped virus which makes it very resistant to disinfectants and the environment. Pig Parvovirus is different from other parvoviruses affecting dogs and cats.  Parvovirus particles in the electron-microscope
Age group	Only fetuses. To calculate the age of the foetus use the crown to rump length in cm = x. The age of the foetus is equal to 21.07 + 0.311x. More simply this can be remembered as: (Crown-rump in mm/3)+21 = days
Clinical signs	
Piglets growers adults	None. Parvovirus has a possible role in the Post-weaning Multisystemic Wasting Syndrome.
Foetuses  Returns  Mummified  Stillborn/weak	The effects depend on the age of the foetus resulting in death or weakness
	Age foetus infected: Effect on the foetus
	10-30 days of age: Death and reabsorption ï mother returns to oestrus
	30-70 days of age: Death and mummification Bone develops after 35 days therefore reabsorption cannot occur
	70 - term: Birth of weak piglets and mummification. After day 70 the piglet is able to mount a weak immune response to fight the disease itself but may weaken the foetus
	The disease is able to move across the placenta and then to each foetus along the uterus. Therefore, the foetuses die at various ages/stages of pregnancy, and therefore have a variety of crown-rump lengths ï which helps to differentiate from mycotoxins. In the sow the clinical picture is Stillbirths, Mummified piglets, Embryonic Deaths, Infertility, and the production of a significantly reduced born alive - SMEDI Parvovirus is an unlikely diagnosis when the born alive is over 8. Abortion is not a feature of Parvovirus infections
Diagnosis	Serology and virus isolation
Infectivity	The disease can be transmitted 30 km by air. The disease can be transmitted via semen Buildings remain infective for 4 months
Treatment	None to the infected animals
	Vaccination Note maternal antibodies are persistent to 6 months of age. Therefore, vaccination must be delayed in breeding gilts until over 6 months of age. In normal instances there is no requirement for second vaccination as the field strain will óvaccinateô the gilt. Field immunity is probably lifelong. Check field strain presence by serology
	As an alternative to routine vaccination, some farms will blood test every 3 months a batch of gilts over 6 months of age. If serological evidence of circulating farm parvovirus exists and feedback/introduction programmes are good, there is no requirement to vaccinate
	Feedback and introduction programmes It is essential to ensure that all new breeding stock is properly introduced onto the farm. Weaner faeces may be a good source of parvovirus particles and can be used in feedback programmes.
Differentials	Mycotoxins, Enterovirus, Torque Teno Virus, Circovirus 2. Other reproductive problems
Zoonotic	None

PREGNANCY DIAGNOSIS

Probe position





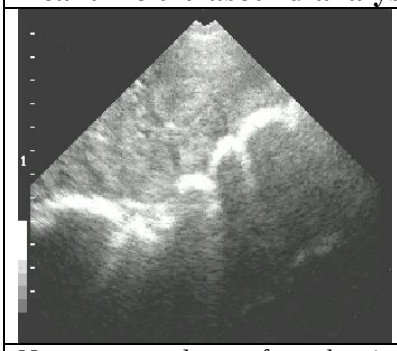
Place probe against flank aim just behind opposite shoulder and slowly rotate hand backwards

Pregnancy diagnosis 	1-115 days	**In the presence of the boar**
	18-24 days	In the presence of the boar checking for regular oestrus return
	25-34 days	In the presence of the boar to check for late returns
	28 days	With the Doppler machine for uterine pulse Real time ultrasound
	35 days	With the Doppler machine for uterine pulse Real time ultrasound
	8 weeks	By eye, looking for dropped abdomen Any questionable sow, recheck with Doppler for uterine pulse and foetal pulse or real time for foetus
False positives	False uterine pulse when the sow is coming or in season. This is why you need two positives (28 and 35 days) to be confident that the sow is pregnant	
	Always check that the Doppler machine is well serviced and has a well charged battery	
	Regularly re-listen to the teaching tape	
	Use plenty of gel between the head and the sow's body wall	
Interpretation	A sow which records one negative must be rechecked the following day	
	A sow with two negatives must go back to the boar and be rechecked	
	A sow wrongly believed to be in pig post 35 days costs you around 7 kg deadweight produced a day	

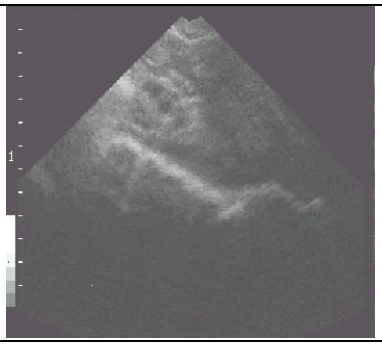
Result interpretation using a Doppler

	28 days	35 days	Significance
Result	+ve	+ve	Pregnant
Result	-ve	+ve	Coming into second oestrus return
Result	+ve	-ve	Embryonic death possibly
Result	-ve	-ve	Not pregnant

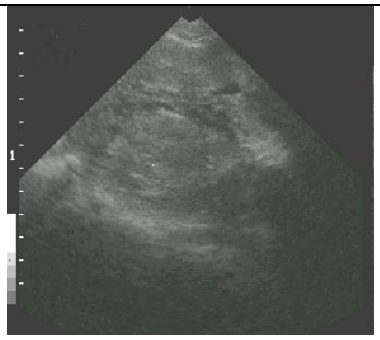
Real time ultrasound analysis



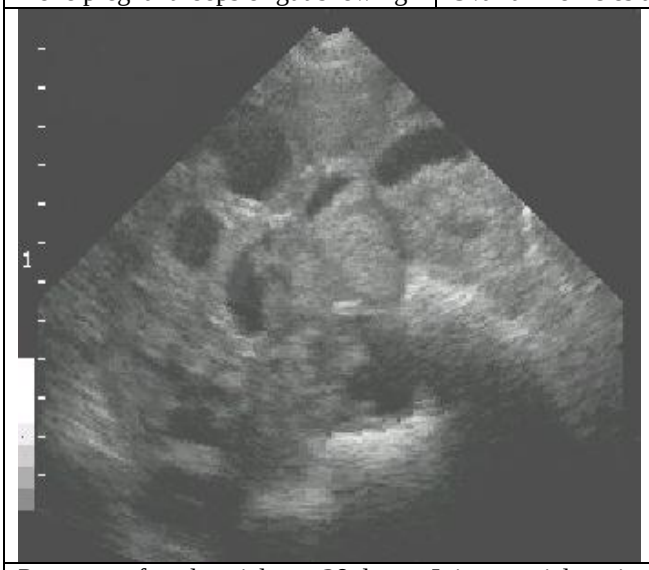
None pregnant loops of gut showing



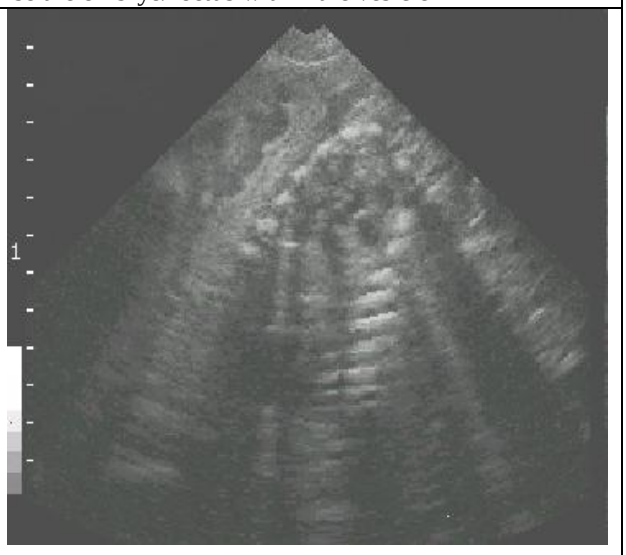
Ovarian Follicles and uterine outline



Sow in oestrus



Pregnancy foetal vesicles at 28 days. It is essential to visualise the embryo/foetus within the vesicle



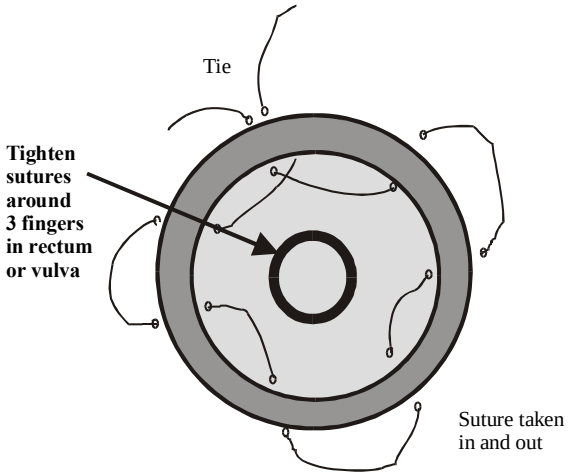
Foetal skeleton

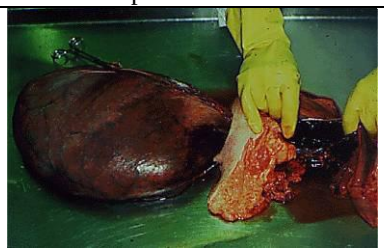
RECTAL AND VAGINAL PROLAPSE

Causes	
Rectal prolapse Sows and growing pigs	Quite common, in sows particular just before and after farrowing
	May be associated with oestrus in sows
	Constipation, low fibre and water shortages
	Excessive slope to the floor. Sow with too short a lying area where their perianal region hangs over.
	Excessive abdominal straining associated with feeding or piling of pigs. Note condition of the floor and stocking rates.
	Mycotoxins
	Low fibre in the diet (normal about 5%)
	Diseases resulting in diarrhoea, colitis and coughing - increasing abdominal pressure
	Too short tail docking resulting in poor anal sphincter action
Vaginal prolapse	More common in older sows than younger, mainly over parity 5
	Fat sows with large litters
	Floors with excessive slope
	High feed intake and fermentable feed increasing abdominal pressure
	Stretching and relaxation of pelvic ligaments
Uterine Prolapse	Occurs infrequently after farrowing. The sow presents with the whole uterus prolapses. Majority of sows will die of shock. It is possible to replace the uterus but the condition is generally fatal. Once the uterus is replaced high concentrations of potassium in the compromised tissues, may lead to heart failure in the sow. If the sow survives replacement or amputation, culling should occur.
Bladder prolapse	Rare, but presents during farrowing as a large sack visible at the vulval lips and interferes with the farrowing process. Emergency euthanasia and caesarean section should be performed to save other piglets. It is occasionally possible to drain the bladder and replace through the urethra.
Treatment of rectal or vaginal prolapse	
Growing pig	Leave in pen to be bitten off by pen mates. This might lead to a rectal stricture but the suturing treatment is just as likely to lead to a stricture. If pig over 60 kg it is likely to reach bacon weight. If you are used to replacing and suturing a prolapse, continue to method below. There appears to be an association between wheat feed and rectal prolapse in the growing pig.
Sow	Replace and retain with a purse string suture
Equipment required to replace a rectal or vaginal prolapse	
	Large curved needle 2 inches or 5 cm and scissors
	Suture tape or nylon stitching for growing pigs
	Warm water and antiseptic
	Obstetrical lubricant
Method	
1	If the pig is in a pen remove it and place it on its own
2	Sedate or restrain the pig. In growing pigs it is possible to place a bucket over its head or hold over a wall. In sows place in a crate
3	Clean the area around the prolapse and remove all faeces
4	Carefully return the prolapse into the rectum or vagina. This may take a little time. Be patient and gentle pushing. With vaginal prolapses the wall can become very oedematous (jelly like) and it is easy to push your fingers through the outer wall. Don't worry if this happens once or twice.
5	Once the prolapse has been returned start stitching using a purse string suture. The prolapse is likely to be pushed out again but do not worry continue stitching replacing the prolapse when it gets in the way
6	Infiltration with local anaesthesia around the anal or vaginal ring may be used
7	Start the purse string suture under the tail and move round taking reasonable bites with the needle. It will take 6 to 8 in and out moves to go all the way round.
8	At the end 'over sew' so the area to be tied will be strong
9	Push the prolapse back in again and hold it in

10	Pull the two ends of the suture closed. Place three fingers (depends on the size of the animal) into the rectum or vagina and pull the sutures tight around your fingers. There has to be sufficient room for the animal to defecate and urinate.
11	Inject the animal with a suitable antibiotic for example penicillin/streptomycin ï note withdrawal times.
12	Put some liquid paraffin (0.75 litres per adult sow) into the mouth or feed to help soften the faeces

The purse string suture



	
Prolapsed rectum sow	Prolapsed uterus in the postmortem room
	
Prolapsed bladder through the vulva	Perineal prolapse/hernia

ANALYSIS OF RETURNS TO BREEDING IN THE PIG

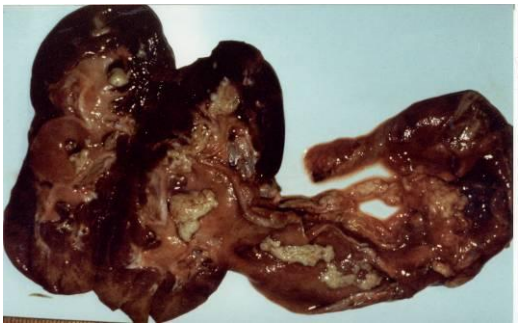
Veterinarians are frequently asked to analyse reproductive problems. However, the information provided by farmers and computer systems are generally not in a format which allows for easy interpretation.

Failure to farrow interpretation
Not all failure to farrow problems is associated with reproductive problems. The initial examination must determine the reasons for failure to farrow.
Table 1

Reasons for failure to farrow

Reason	Target %	% of failure to farrow
Returns to oestrus	12	66
Abortions	1-1.5	8
Not in pig pigs (moved to farrowing house found not in pig)	0.5-1	6
Culled in pig	1-2	10
Died in pig	1-2	10
Resulting farrowing rate	82	

Non reproductive reasons are commonly found to be the actual cause of the reproductive problem, for instance cystitis and pyelonephritis can dramatically increase death while pregnant (up to 10%) and can thus appear as a reproductive problem, while in fact most sows die with a uterus full of piglets.



Chronic active pyelonephritis (streptococcus)

Returns to oestrus can also be given targets

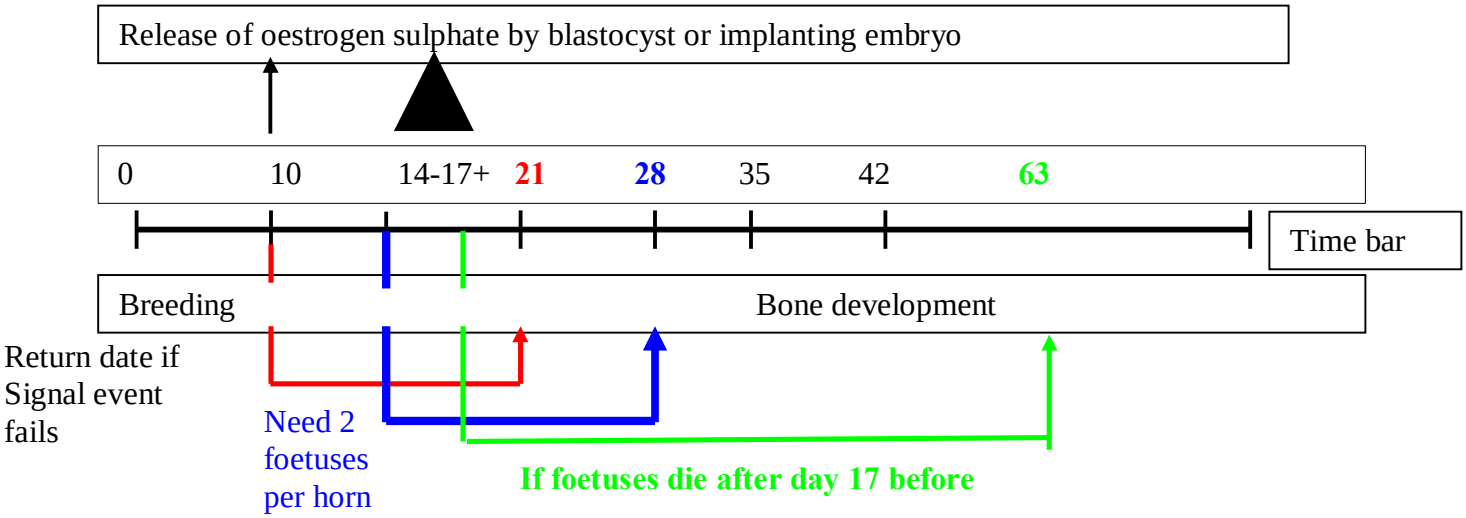
Target for return to oestrus

Type of return	Target %
Regular returns 18-24 and 36-48 days post service	80
Irregular returns (any other time)	20

Analysis of return to re-service interval

An understanding of basic embryonic signalling provides a simple interpretation of returns to service, which can be used to help explain sows which fail to breed and assists in the differential diagnosis.

This is illustrated in below.



Basic early embryonic signals and their influence on failure to maintain pregnancy (from Geisert *et al* 1990).

Day post conception	Event	If event fails
10	Oestrogen sulphate is released by the free-living blastocyst	Female returns at 18 ï 24 days post service ï peak at 21 days
14-17 and 2 embryos implant per uterine horn	Oestrogen sulphate is released by the implanting embryo	Female returns at 25 ï 35 days post-service ï peak at 28 days
Implanted embryo dies shortly after day 17 but before day 35		Female returns after day 50 ï peak at 63 days post-service, a pseudopregnancy

Utilising this information, a basic guide to why sows return to service can be compiled.

Major reasons why sows return to service

Day of repeat	Reason for return
0-17	Nymphomaniac (follicular cyst - rare). Not in season initially
18-24	Oestrus (failure of blastocysts to reach day 10)
25-35	Embryonic death (failure of 4 piglets to implant). Not in season initially
36-48	Missed oestrus. Missed embryonic death + oestrus. Not in season initially + oestrus missed.
49-80	Pseudopregnancy. Abortion. Combinations of above.
80 +	Combinations of above.

This implies that a lot of returns to service are poor oestrus detection rather than disease agents, which may be difficult for some stockpeople to accept.

Influence of stockpeople on reproductive success

Unfortunately dishonesty is a frequent cause of reproductive problems, particularly when results are disappointing and bonuses are affected. Always be very wary of the leaving employee who has direct influence on reproduction, i.e. the breeding stockman or manager. In addition observation of stockpeopleôs attitudes during breeding can be very revealing.

Good stockmanship interaction during breeding


The sow is talking to the boar and is not distracted by other sows. The stockman has full body contact with the sow. The stockman talks and encourages the sow providing stimulation to the flanks of the sow with the knee and touch on the flanks and udder. Using body pressure and the hands press on the back and loin area mimicking the boars mounting position. Riding the sow can also be useful, but note obvious health and safety issues.

Poor stockman interactions with the breeding sow


The sow is distracted by other sows. No boar presence. The stockman has no physical contact with the sow, aside from some minor back pressure using the hand in the left photograph. The stockman does not talk or provide any encouragement to the sow.

The use of artificial boars as saddles etc. during breeding helps but does not equal the results of a dedicated stockperson

STILLBIRTHS AND MUMMIFICATIONS

70-90% of stillborn piglets occur during farrowing. PRRSv is a major cause of pre-farrowing death

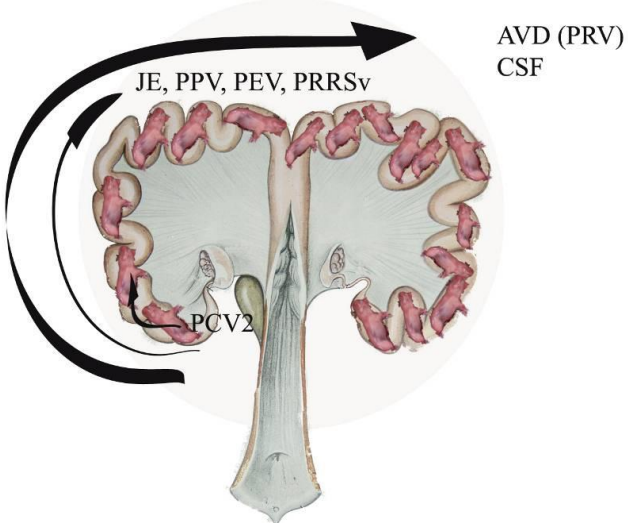
Recognising the stillborn piglet		
		
Mummified piglets. The age can be estimated by crown to rump length in mm divided by 3 and add 21 = days	Thimbles covering the feet are worn down within 15 minutes of life	Presence of long umbilical cord and meconium (piglet faeces on skin)

Reducing stillbirths		
1	Supervision	Every 30 minutes. Use oxytocin 5-10IU. Prostaglandin inducement. Manual interference
2	Age of the sow	Stillbirths increase after parity 7
3	Increase in litter size	Stillbirths increase after 12 total born
4	Recognise the problem sow	From the previous litter and age etc.
5	Slow farrowings	Normal farrowing less than 8 hours. If longer consider low Iron or Calcium in the blood. Normal Fe > 9 µmol/l or Ca > 1.9 mmol/l.
6	Sow feeding /condition	Over fat sows have longer farrowings. Lack of exercise results in longer farrowing times. High parasite levels or disease will increase farrowing times or result in poor uterine tone (push effect)
7	Temperature of farrowing house	Keep below 20ÅC. Watch placement of rear heat lamp
8	Nutrition/water	Water flow rate needs to be greater than 2 litres per minute. Increase fibre before farrowing. Both help to reduce constipation. Do not overfeed before farrowing as it will lead to oedema.
9	Vaccination	Parvovirus to gilts single injection on arrival
10	Crate design	Allow sufficient room for stockpeople to comfortably attend to the sow at farrowing time. Reduce stress and do not have sows cramped when lying down. No draughts, watch door closure policy. Have lights dimmed and not too bright. Playing music will help to settle sows. Intermingle sows and gilts
11	Management of piglet tasks	Try not to teeth clip, tattoo etc. piglets within hearing of sows farrowing to reduce stress
12	Feed back	Feedback faecal material from weaners and farrowing house to gilts and sows. Depends on farm situation, consult with vet. Feedback helps to stablise the sowôs immunity to Enteroviruses, Torque Teno Virus and Circoviruses.

Mummified pigs causes and control		
1	Parvovirus	Vaccinate gilts on arrival older than 6 months and two weeks before first service. Ensure feedback programme effective.
2	PRRSv	If unit positive, ensure new gilts receive feedback from weaners and have contact with cull growers. Vaccinate gilts and boars in isolation before moving into a positive herd
3	Mycotoxins	Ensure gestating sows do not have access to mouldy feed. Watch feed bin management and the management of the forward feed troughs
4	Leptospirosis	Ensure rats do not have access to the water supply. Control rodents around the farm. Have two wallows available in rotation allow one to dry out completely before refilling
5	Other SMEDI pathogens: Enteroviruses, Torque Teno Virus and Circoviruses	Hygiene, feedback to reduce likelihood of infection
6	Trauma	Reduce mixing stressors and moving of sows, particularly through narrow doorways.

Reproductive pathogens

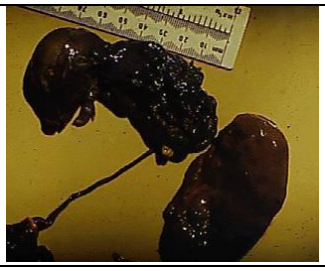
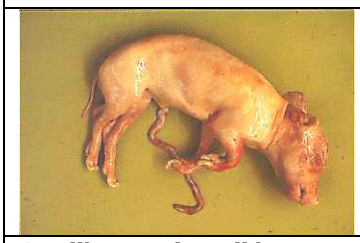
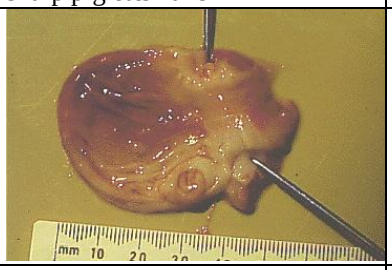
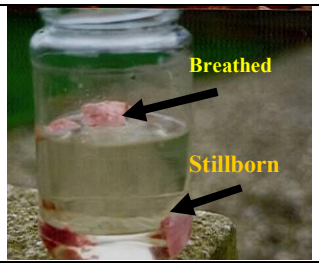
Spread intra-utero of pathogens between the foetii within the uterus



Pathogen		Spread to # of adjacent foetus
Porcine Circovirus 2	PCV2	Next foetus
Japanese Encephalomyelitis virus	JE	Next couple up to 5
Porcine Parvovirus	PPV	
Porcine Enterovirus	PEV	
Porcine Reproductive and Respiratory Syndrome Virus	PRRSv	
Aujeszkyôs Disease (Pseudorabies)	AVD (PRV)	Can affect all embryos rapidly
Classical Swine Fever	CSF	

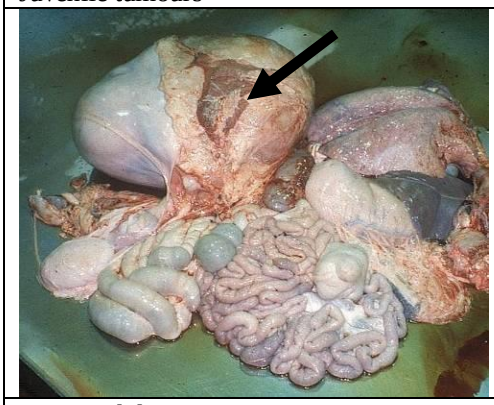
Stillborn Diagnosis

It is important to differentiate between those animals which are stillborn and those who died with pre-weaning mortality

		
Mummified piglet are obviously piglets which have died	Pre-partum stillborns can be easily recognized if partially autolysed, as shown. PRRSv a major cause	Fresh piglets are more difficult, check the opacity of the cornea. Freshly dead (less than 24 hours) the cornea will still be clear
		
A stillborn piglet will be wet with a long wet umbilical cord	Check the feet for ósippersô which protect the uterus from the sharp pigletôs nails	A piglet will rub off their slippers in about 15 minutes
		
Meconium will be present on the skin, in the mouth, trachea and stomach. The meconium is the feaces in the unborn pigletôs large bowel, passed when they go anoxic	The stomach will only contain fluid with some meconium, there will be no milk or colostrum	A stillborn pigletôs lung will sink in water, whereas if the piglet breathed, its lungs will float
		Remember to check for the obvious ï stillborn piglets will not be ear notched, tail docked, teeth clipped or tattooed. It will not have umbilical clips etc
Even óobviouslyô stillborn piglets may be born alive	Stillborn piglet with the umbilical cord around its neck	

TUMOURS OF SWINE

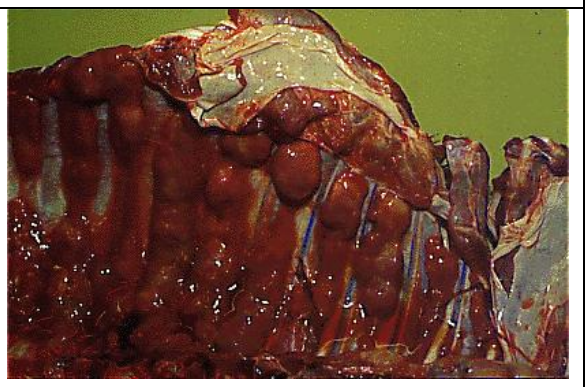
Juvenile tumours



Nephroblastoma The large mass (arrowed) is the right kidney, which is grossly enlarged into a nephroblastoma.

This tumor develops from the renal blastema. Generally the tumour is discovered at slaughter as an incidental finding

Young adult



Lymphosarcoma

Lymphosarcoma classically affects young adults ï gilt or 1st parity sows. The sow loses weight rapidly and is unresponsive to treatment. At post-mortem, lesions associated with swollen lymph nodes are found scattered throughout the carcase. The right photograph reveals the swollen chain of lymph nodes associated with the rib cage.

Middle aged adult

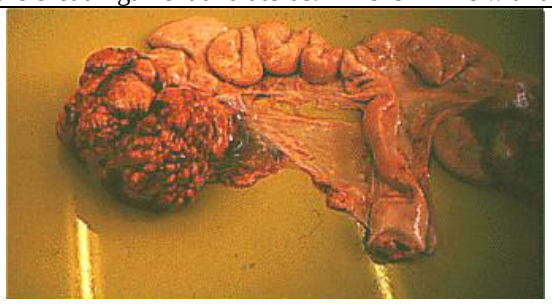
Skin tumours

Melanoma and other skin tumorsï are not infrequently found in pet pigs. Tumors can be removed surgically or reviewed over time. Many of these lumps remain very static over a long period of time without causing any problems or irritation to the pig.

Elderly adult

Reproductive tumors

Large leiomyoma pre-surgical and the tumour being removed- Pictures Dr K Mozzachio
Tumours of the older female reproductive tract are being increasingly reported particularly associated with the broad ligament and uterus. This is in line with the increasing age of pet pigs.

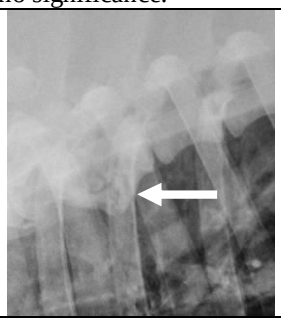


This large ovarian tumour was removed from a pig

Sertoli cell tumour ï cut surface through testes shown

Tumours also occur elsewhere; this is a tumour of the thyroid.

Scrotal haemangioma ï these can be very common with little or no significance.



Elderly pig which suddenly went off her back legs
X-ray revealed a tumour ï lymphoma ï under the spinal column - arrowed

14 TO 21 DAY POST-SERVICE VULVAL DISCHARGE

Definition	Infection of the uterus during breeding, which is released at the next oestrus
Clinical signs	Sows with a creamy cheesy discharge from the vulva 14-21 days post-mating without blood. The sow subsequently repeats at 18-24 days post-mating.
Causal agent	None specifically identified. *Escherichia coli* (*E. coli*), staphylococcus, streptococcus and klebsiella are often isolated from swabs
Management factors	Infection of the genital tract late in oestrus

14-21 day post-service vulval discharge

Traumatic post-service discharge

Treatment	
Individual	
1	If the sow returns to oestrus 18 to 21 days post-service, cull the sow
2	No antimicrobial therapy will be effective at stopping discharge or maintaining 'pregnancy'
Herd	
Breeding control	
	Two services only are needed 24 hours apart am/am ideally
	Only serve sows in standing heat recognised the signs of oestrus. Late serving is strongly associated with 14-21 day vulval discharges
	Use all clean artificial insemination
Breeding area hygiene	
	At all times stalled sows must be separated from her urine and faeces
	Clean any sow with a soiled rear prior to service. Ideally this should be done on arrival to service area
	Avoid human contact with the boar's penis during service, only use prepuce to direct penis
	Ensure that the underline of the boar is kept clean by managing the boar in a clean dry environment
	Ensure service is carried out on a good non slip floor
	Do not serve lame sows with boars, only use AI
	Cease heat checking by 'thumbing'
	Ensure AI service carried out by single use disposable catheters
Farrowing house management	
To limit trauma and infection of the vagina and bladder	
	Improve hygiene behind the sow by manually removing faeces 3 days prior and 7 days post-farrowing. Very dirty rear regions should be cleaned with soap and water
	Reduce manual farrowing as much as possible, use plastic gloves and clean hands
	All sows manually farrowed should receive a suitable antibiotic by 16 g 1.5" needle intramuscularly into the neck
	Encourage the correct use of oxytocin at 5 IU doses
	Ideally increase lactating length to 24 days
Increase water supplies to flush out vagina	
	Heat check three times daily in breeding area and ensure sows rise and urinate
	Ensure water supplies clean and freely available
Antibiotic therapy	
	Consult your veterinarian
Zoonotic	None

ANAESTHESIA IN THE PIG
GENERAL INTRODUCTION

Pre-surgery

If the surgery is elective, it may be necessary to get a movement licence before moving the pig to the surgery.

The pig is starved for 12 hours prior to surgery and water removed 6 hours before surgery. Note the pig is very prone to gastric ulceration which can start within 24 hours of not eating.

Pre-medication

Depending on the pig, pre-medication can start at home with the administration of acepromazine maleate oral tablets provided via a small apple or chocolate bar at a rate of 1-2 mg/kg. Alternatively, the pig can be pre-medicated with 0.1 mg/kg acepromazine maleate injection intramuscular. Intramuscular injection of a combination of ketamine (20mg/kg) and xylazine (2 mg/kg) has proven to be extremely good at knocking the pig down.

Azaperone (Stresnil) is a sedative used commercially in pigs (not available in the USA), however, while it is good for calming sows at mixing and farrowing, It is unsuitable as a pre-medication as the pig will go into an excitable phase on handling making intravenous injection difficult/dangerous.

Note with many sedatives, penile prolapse (paraphimosis) can occur and owners need to be warned that this can be permanent.

In several countries a convenient method of sedation is using an intramuscular injection of Telazol® (Zoiletil® Australian)- xylazine-ketamine mixture (ñTKXò). Reconstitute powdered Telazol® with 250mg xylazine (2.5ml) and 250mg ketamine (2.5ml). Dose at 1ml/25-35kg.
Alternative could be intramuscular injection of xylazine 0.5-2.2 mg/kg IM and Telazol® 3-6 mg/kg IM.

Anaesthesia

Anaesthesia is achieved using thiopental sodium intravenous (approximately 10 mg/kg to effect) using an ear vein. The pig should be restrained at all times. While the pig may squeal, the easiest and less stressful technique for both pig and operator is the snout restraint.

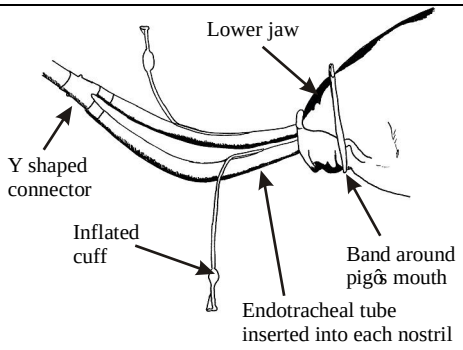
The sedated pigôs ear veins are raised by applying pressure at the base of the ear. Using a surgical swab the ear veins are visualised. A needle (butterfly catheter) is inserted ï in the larger Vietnamese pigs an 18 gauge needle is used. Drawback is not performed as the ear vein normally collapses. Injecting a very small amount of anaesthetic will indicate if the needle is properly placed. Note, a large amount of barbituate injected into the perivascular tissues can lead to a degree of necrosis and potentially permanent damage to the ear.

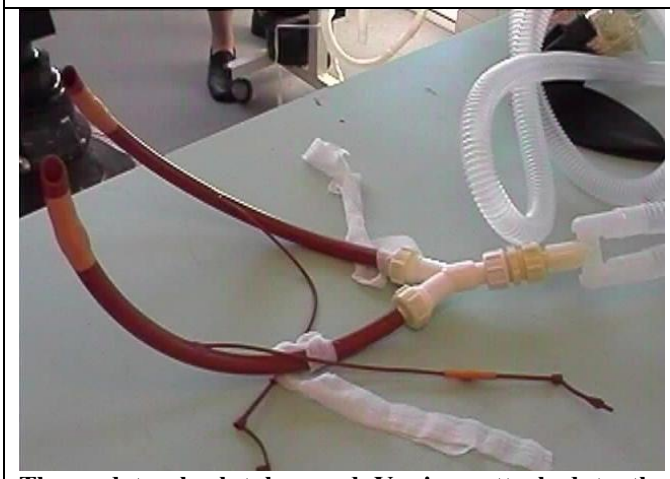
Once the pig is anaesthetised, anaesthesia is maintained using isoflurane on a circle anaesthetic machine. Intubation of the pig is more complex than in the dog as the larynx is anatomically difficult to visualise and locate. Masking poses a risk of not achieving a good seal. The technique of intranasal intubation can be utilised.

A 90 kg pig will take a 9 mm endotracheal tube

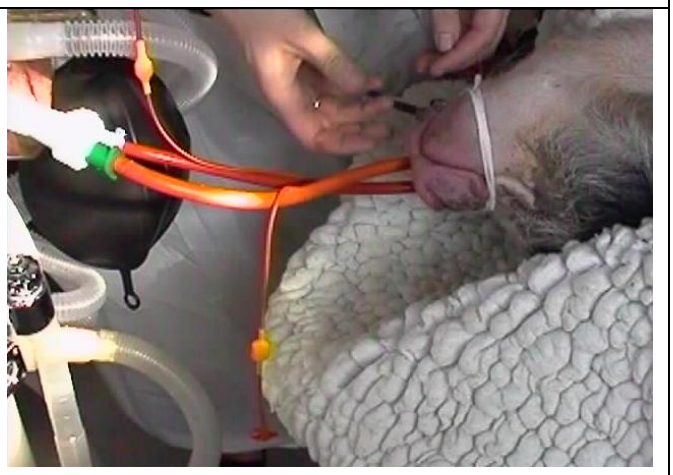
A 60 kg pig will take a 7 mm endotracheal tube

A 30 kg pig will take a 5 mm endotracheal tube





The endotracheal tubes and Y piece attached to the circle



Pig anaesthetised

Once inserted with a twisting action past the nares, the cuff can be inflated and the mouth closed with tape. The pig will then breathe normally through the nose. Anaesthesia can be easily maintained using this technique.

Post surgical

Pain relief using ketoprofen 3 mg/kg or butorphenol. Note phenylbutazone cannot be used in farm animals and pet pigs fall into this category.

Post-operative antibiotic cover provided using amoxycillin 7-10 mg/kg. Tablets may be provided. These can be relatively easily administered using apples. Partially core an apple, place the tablets into the apple and replace the core. Feed to the pig that will normally eat with relish.

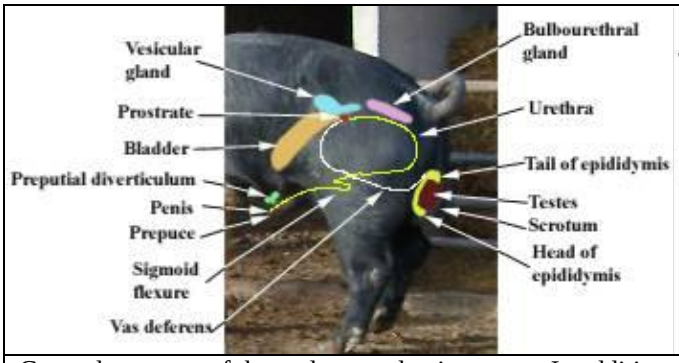
Surgical Procedures in Pigs

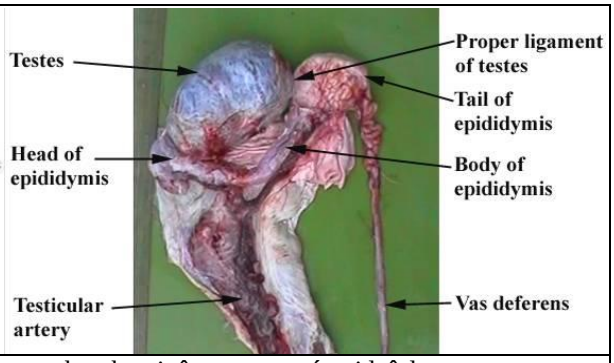
Castration in the Piglet

No anesthesia is required if the piglet is castrated before 3 weeks of age. Once castrated the piglet should be returned immediately to his mother.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Place the piglet between your legs with the chest held by the legs. The piglet will stop struggling quickly.</td><td>Push the testicle up and check for scrotal hernias. Do not continue with open castration if a hernia is suspected.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>With a surgical blade incise over the midline of the scrotum</td><td>The testes will prolapse through the cut</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Push the testes out of the cut. Grasp the testes between finger and thumb and with a pulling and twisting action remove from the pig</td><td>Ensure no remnants of the vaginal tunic remains on the outside of the pig. Remove the other testes and then return the piglet to his mother.</td></tr>
</table>

Castration in the Piglet with a Piglet Holder





General anatomy of the male reproductive tract. In addition note that the pigôs testes are óupsideô down.

No anaesthesia is required if the piglet is castrated before 3 weeks of age.

Front Back

Using a piglet holder from some 12 cm diameter polypipe. Leave 10 cm entire and cut away 30 cm as a back support blade.	Place the piglet head down into the holder which is supported on a pole on the processing cart.	Restrain the waist with tape with Velcro. The tape is bolted onto the back of the blade ï see arrow left picture.	Pick up the blade and hold the hind legs down. This exposes the testicles.

Examine for any hernia or defect of the testicles. If present stop the castration or change technique

Using a blade cutting away from yourself cut into each scrotum.	Cut the into the right and then the left scrotum. Use a firm stroke mid scrotum.	With a firm grasp remove each testicle with a twist and a pull.	Ensure no tag is left hanging. Consider spraying the wound with iodine.

Once castrated the piglet should be returned immediately to his mother.

Castration in the Adult Pig

Check the pig over as part of the normal anaesthesia requirements

Clip the area of the scrotum and inner groin

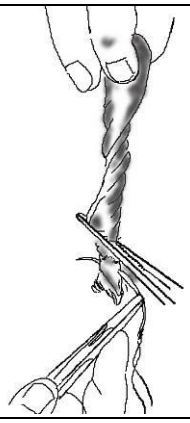
Make an incision midline just in front of the scrotum. Push the top testes through the incision

Twist the testicle cord. Clamp and ligate the vaginal tunic. Pull to separate the tunic above the ligation. Push the other testes through the midline incision and remove.

Stitch the two vaginal tunics closed. Close the subcutaneous tissues and finally the skin

Allow recovery from the anaesthesia

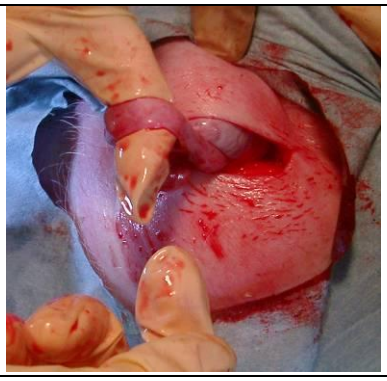
Scrotal Hernia Repair in the Pig

<table>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Identify the pig with the scrotal hernia. A means of holding the pig makes repair easier</td><td>Push the scrotal hernia up into the groin</td><td>Incise the skin over the hernia. Do not puncture the vaginal tunic</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Grasp the testes and free it by blunt dissection.</td><td colspan="2">Twist the testes and vaginal tunic, pushing any intestinal contents back into the abdomen</td></tr>
<tr><td>  </td><td>Cut the cord above the vicryl stitch or vaginal tunic knot.

Place a mattress stitch into the skin to close the wound.

Allow the piglet weaner to recover in a warm box.</td><td>  </td></tr>
<tr><td colspan="2">Tie off the base of the twist using 0 vicryl placing a stay stitch into the base of the twisted vaginal tunic. It may be possible to knot the twisted vaginal tunic.</td><td>Do not use electrical ties that will be found after slaughter (arrow)</td></tr>
</table>

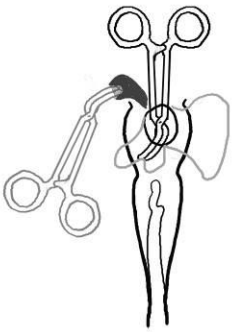
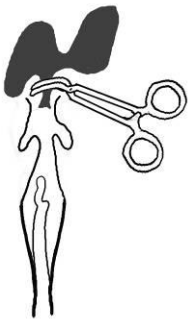
Epididectomy in the Pig

		
Place the pig in left lateral recumbency. Clean and prepare the scrotal area.	Drape over the two testes	Incise over the right (upper) top of the testes ï over the tail of the epididymis
		
The tail of the epididymis will be visible through the incision.	By blunt dissection pull the tail of the epididymis and push your fingers through the mesentery between the testes and epididymis	Pull the epididymis free from the testes by breaking down the testicular ligament and pull on the epididymis until the vaginal tunic breaks
		
The testes will be seen exposed	Close the wound, the vaginal tunic, subcutaneous and scrotal skin.	Assuming that the epididectomy is successful, castrate the pig on the other side.
	Allow the pig to recover from the anaesthesia. It is possible to carry out a similar procedure on piglets at 10 days of age without anaesthetic. Check the absence of semen before using the boar on a sow	

Ventral Vasectomy in the Pig

		
Place the pig on its back and prepare the area between the groin	A single incision is made midline or two incisions in the groin groove. Note the large blood vessels in the groin.	Cut down through the skin and muscle layers. The vaginal tunic will be felt under the finger as a mobile tube
		
Finding the vas deferens can be assisted by the assistant pushing up on the testes.	Carefully cut through the vaginal tunic, the vas deferens will be seen as a white tube. Release the vas deferens by pushing artery forceps through the interstitial tissues. Pulling on the released vas deferens will pull on the testes.	Once you are sure the vas deferens are released. Place sutures and ligate the vas deferens at the proximal end. Use 0 vicryl. Nylon may be found at slaughter and should be avoided.
		
Repeat the ligature at the distal end of the vas deferens ï about 9 cm further down the vas deferens.	The vas deferens can be confirmed by rolling the removed duct and seeing the central hole as shown. Place the removed vas into 10% formaldehyde.	Repeat the removal of the vas deferens on the opposite side. Close the incision, closure of the vaginal tunic, muscle, submucosal layers and skin layers.
	Allow the pig to recover from the anaesthesia.	

Ablation of the Preputial Diverticulum in the Pig

	
Place the boar onto its back. Clean around the prepuce. There may be hairs at the entrance to the prepuce; these will need to be trimmed.	Place an artery forcep into the preputial os. It may be possible to partially evert the prepuce to demonstrate the entrance to the duct leading to the preputial diverticulum
	
Insert the forceps into the depth of one of the sacs of the preputial diverticulum and catch a portion of the wall. Pull gently and progressively. Over time it will be possible to evert the prepucial diverticulum.	Eventually the preputial diverticulum can be completely everted. It might tear but will generally come out intact. Place a pair of forceps around the duct. Tie off the preputial diverticulum at the level of the duct
	Remove the preputial diverticulum. Invert the preputial mucosa. Administer routine post-surgery pain relief and antibiotics.

OvarioHysterectomy in the Sow or Gilt

Check the pig regularly though the surgery

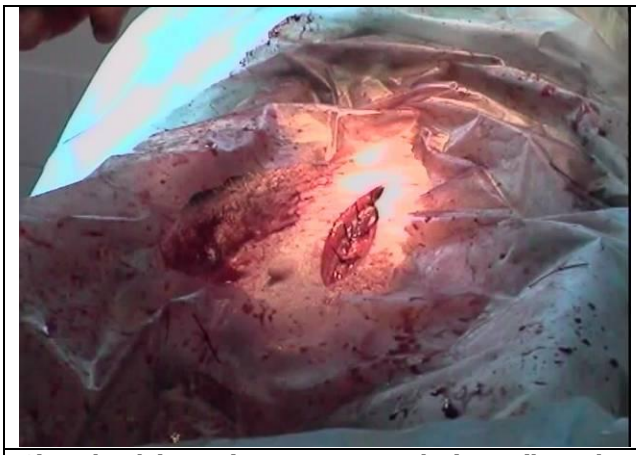
Place the pig in dorsal recumbency. Make a midline incision through the linea alba just behind the umbilicus. The incision should be about 6 cm long

The uterus is normally very easy to find. Retract the horn forward to the ovary.
Ligate the ovarian artery and incise

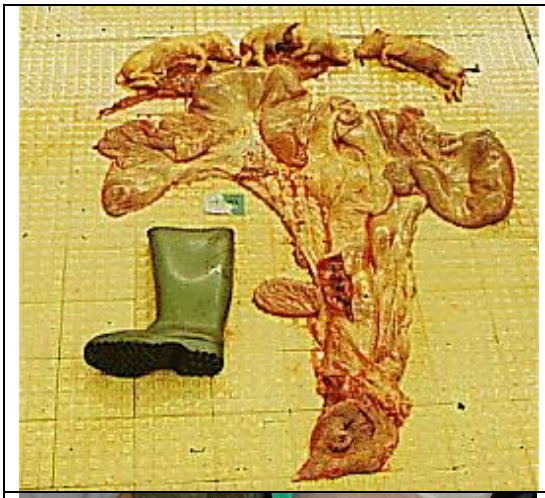
Ligate and incise through the broad ligament vessels. These can be very large. The uterine body will need to be ligated in sections

Cut through the body of the uterine horn

The uterus and ovaries removed

	
Close the abdominal incision, suture the linea alba with Vicryl or PDS III. The muscles and subcutaneous layers are closed by catgut, vicryl, PDS or Dexon	Close the skin incision. (Subcutaneous closure with absorbable suture so there are no sutures to remove later)
	
The skin incision after subcutaneous sutures	Post-operative care to ensure comfortable recovery
	Examine the pig 2 weeks post-operation and examine the scar

Caesarian Section



The pregnant uterus will be very large. Each uterine horn can reach 2 metres.

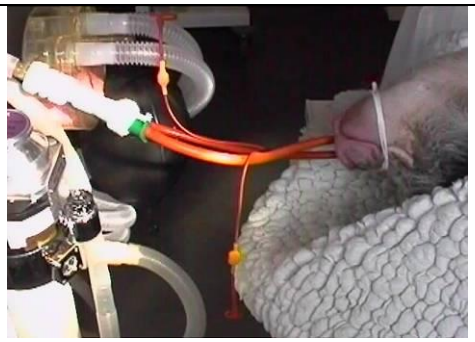
There is the possibility of 12 plus piglets.

Preparation:
Clean pig. It might be necessary to carry out the surgery in the farrowing crate.

In pet pigs a full anaesthesia masking the pig down with gas (isoflurane) would be the method of choice.

Sedation and anaesthesia
Sedation is difficult as the piglets will be affected by the sedation. Where possible the sow can be sedated with Stresnil ï Azaperone and the sow anaesthetised by local infiltration of the skin incision with lidocaine.

In pet pigs- propofol intravenous can be use 6 mg/kg. Note this can cause apnoea so a method of manual ventilation is required.



If gaseous anaesthesia is required, use intranasal intubation to administer the isoflurane. Note pigs may be halothane sensitive resulting in PSS

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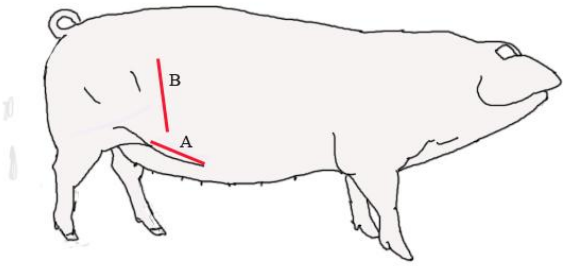
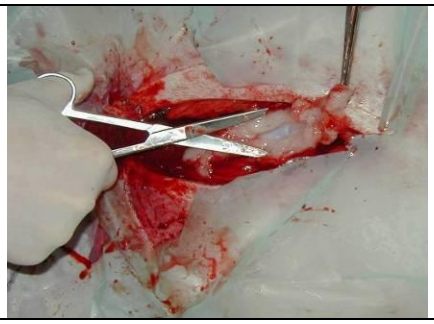
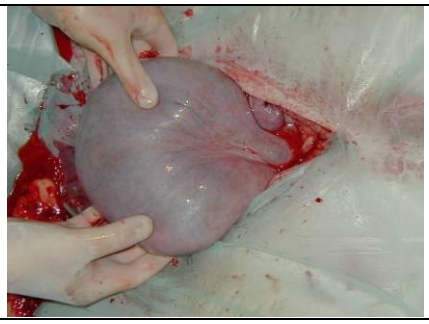
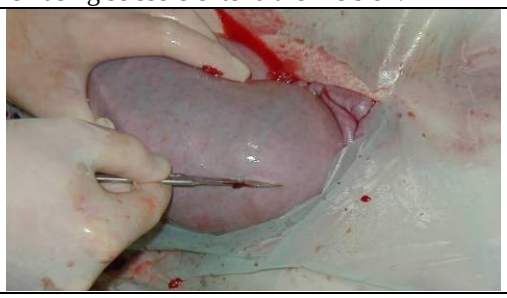
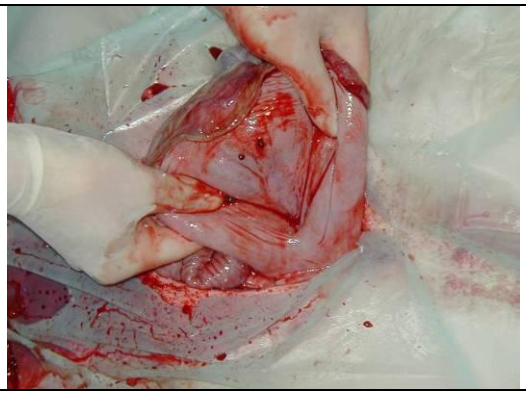
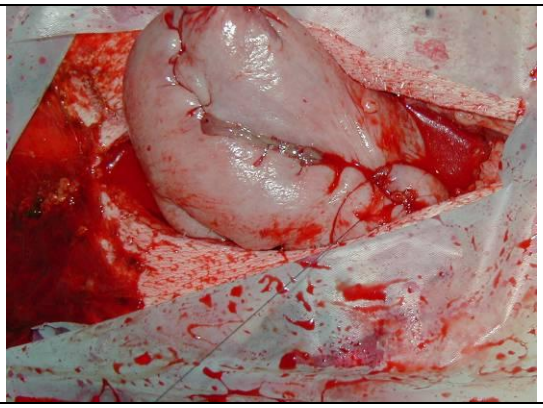
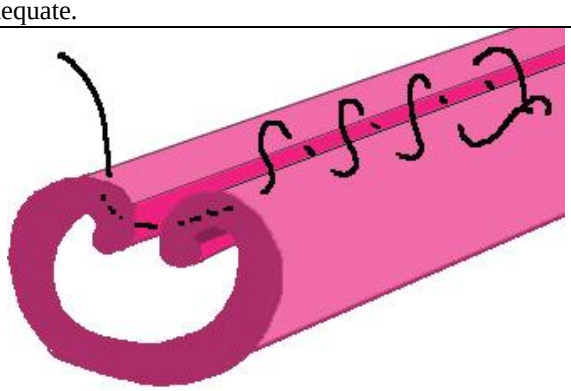
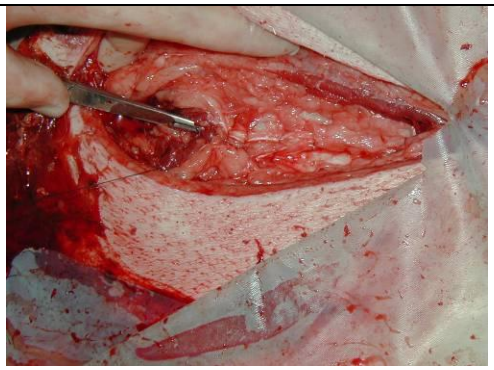
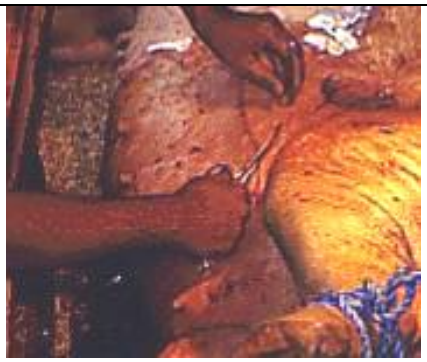
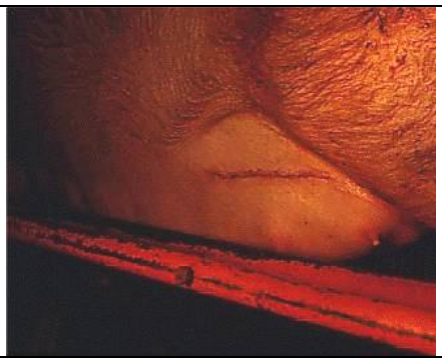
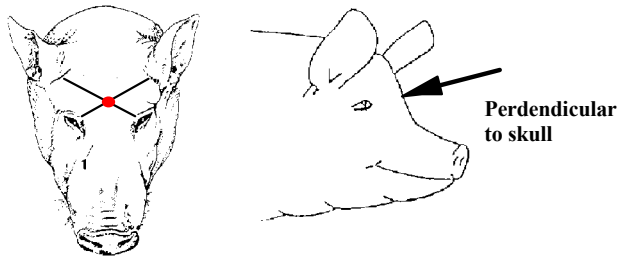
<tr><td> 
</td><td rowspan="2">In commercial breeds (Landrace or Large White) position A is preferred. The incision is made some 12 cm above the teat line (one hands width). This access is used to minimise the amount of subcutaneous fat. In addition the three abdominal muscle layers have merged into one layer. During the subsequent suckling the wound is away from the piglets.</td></tr>
<tr><td>Drawing showing the position of the incision to gain access to the abdomen.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Incise through the skin and muscle layer to the peritoneal layer. Penetrate the peritoneal layer with a scalpel blade and then using scissors extend the incision.</td><td>The uterus is normally very obvious within the abdomen. Remove part of a uterine horn with a piglet inside.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Incise the uterus over the back of the piglet. Take care not to incise into the piglet.</td><td>Remove the piglet and pass to an assistant to encourage respiration. Clear the airways and if necessary use a respiratory stimulant.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Hold the edges of the incised uterus.</td><td>Remove adjacent piglets, higher and lower from the</td></tr>
</table>

	incision. Do not attempt to remove all the piglets through the one hole. Three piglets per uterine incision are adequate.
	
Close the uterine incision using an inverted Lambert stitch and absorbable suture such as PDSII or catgut.	An inverted lembert's stitch.
	
Close the peritoneum cavity with Vicryl or PDSII	Close the muscle layer as one layer. Close the subcutaneous
	
Close the skin with Vicryl using a subcutaneous pattern.	Care for the piglets. Do not allow them to suckle until the sow has reasonably recovered. Provide the piglets with warmth and syringe with a small amount of warm water.

	
Do not provide any milk products as this may interfere with colostrum antibody gut transfer which stops within 6 hours of first milk access. Providing the piglets with colostrum from another sow may be useful	The healing skin incision 2 days post -caesarian

Hysterotomy – specific type of caesarian



In practical terms in commercial farms, a sow in the farrowing house that needs a caesarian section, euthanasia of the sow using a captive bolt or life round killing the sow and rolling the sow onto her back, is generally the best option. It is not necessary to panic; the piglets will be easily resuscitated within 4-5 minutes of the euthanasia of the sow. Make a large midline incision from the xyphoid process to the pelvis, using a large sharp post-mortem knife. Carefully, cut into the abdomen and expose the uterus. Using scissors, cut the uterus over piglets and remove, pass to an assistant who will be responsible for resuscitation.

Hysterectomy derived piglets

It is possible to utilize this technique to obtain hysterectomy derived piglets. The uterus is not opened immediately. The uterus is removed, and placed in a vat of mild disinfectant, moved 50 metres from the euthanised sow and the piglets removed by another team. The piglets are then removed from the area and placed onto another farm. This method is very successful at producing piglets free of parasites, respiratory and digestive diseases. However, any pathogen which can cross the placenta may be transferred with the piglets ï Parvovirus, PRRSv, PCV2 and even *Streptococcus suis* type II for example.