Eutocia, dystocia and caesarean section

Philip Thomas BVSc PhD FACVSc DipACT
Qld Veterinary Specialists,
263 Appleby Rd, Stafford Heights, Q, 4053 Australia.

Normal pregnancy length and parturition
Pregnancy length is not predictable from breeding date (Table 1). In addition, pregnancy length is affected by breed, and litter size, sometimes parity, but not age\(^1\). Parturition date can be predicted from estrus progesterone data, pregnancy fetal sonography (biparietal diameter and body diameter\(^2\) and terminal rectal temperature monitoring.

Parturition can be induced\(^3\) with combinations of aglepristone, 15mg/kg SC 59 to 61 days post-ovulation, plus oxytocin, 0.15IU/kg 24 hours post-aglepristone, with mixed results especially in larger breeds, including delayed births and dystocia.

\(\text{Table 1: Length of pregnancy}\)

<table>
<thead>
<tr>
<th>Length</th>
<th>From breeding date</th>
</tr>
</thead>
<tbody>
<tr>
<td>58 to 72 days</td>
<td>from any breeding date</td>
</tr>
<tr>
<td>64 to 66 days</td>
<td>from the LH peak or progesterone rise &gt;6-8nmol/L</td>
</tr>
<tr>
<td>56 to 58 days</td>
<td>from the first day of cytologic di-oestrus</td>
</tr>
</tbody>
</table>

\(\text{Stage I labor 6–12h: begins with uterine contractions of reducing interval, and ends when stage II begins; bitch may be restless, nervous, panting, pacing, digging; she may have behaviour change, vomiting and shivering; she may or may not be lactating.}\)

\(\text{Stage II (SII, foetal delivery) and III (placental delivery) labor 0–18 hours: begins with abdominal contractions and/or fetal fluid expulsion and/or pup birth; one pup should be born at least every two hours; placentas are typically delivered 0–15 minutes after pup, but may be delivered after all pups; delivery generally alternates between uterine horns; posterior presentation is normal in 40% of pups.}\)

\(\text{Table 2: Indicators of impending parturition}\)

<table>
<thead>
<tr>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 7d</td>
<td>Behavioral change</td>
</tr>
<tr>
<td>12-24h</td>
<td>Nesting intensifies</td>
</tr>
<tr>
<td>0-14d</td>
<td>Lactation</td>
</tr>
<tr>
<td>10-24h</td>
<td>0.5-1.0C drop in rectal temperature compared to the same time 24 hours before</td>
</tr>
<tr>
<td>0-24h</td>
<td>Progesterone &lt;6nmol/L</td>
</tr>
<tr>
<td>0-12h</td>
<td>Foetal heart rates &lt;180bpm but unpredictable</td>
</tr>
</tbody>
</table>
Dystocia
Dystocia is an inability of the bitch to complete eutocia (normal vaginal delivery).

Table 3: Indicators for examination/intervention

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;72d</td>
<td>From any breeding and no labour</td>
</tr>
<tr>
<td>&gt;66d</td>
<td>From LH peak and no labour</td>
</tr>
<tr>
<td>&gt;60d</td>
<td>From day 1 of di-oestrus and no labour</td>
</tr>
<tr>
<td>&gt;24h</td>
<td>From fall in rectal temperature and/or progesterone &lt;6nmol/L with no labour</td>
</tr>
<tr>
<td>&gt;2h</td>
<td>From onset of Stage II labor to pup; or between pups</td>
</tr>
<tr>
<td>&gt;2h</td>
<td>From onset of green or black or bloody vaginal discharge</td>
</tr>
<tr>
<td>&gt;20min</td>
<td>Active continuous abdominal contractions with no pup birth</td>
</tr>
<tr>
<td>&gt;20min</td>
<td>From pup presentation at vulva to birth</td>
</tr>
<tr>
<td>Immediate</td>
<td>Foetal heart rates &lt;160-180bpm</td>
</tr>
<tr>
<td>Immediate</td>
<td>Obstruction to birth canal</td>
</tr>
<tr>
<td>Immediate</td>
<td>Bitch weak, sick, painful</td>
</tr>
</tbody>
</table>

Aetiology: Maternal origin
Systemic: primiparous, >6yo, toy breed, brachycephalic.
Abdominal: age >6y, abdominal hernia, diaphragmatic damage.
Pelvis: immature, fracture, neoplasia, degeneration, developmental anomaly, breed, fat.
Uterus: trauma, rupture, torsion, developmental anomaly.
Endocrine: abnormal estrogen, progesterone, thyroid function, relaxin, prolactin, PGs, oxytocin, other?
Metabolic: abnormal calcium, glucose, electrolytes.
Myometrial: singleton, age, overstretching (large litter).
Cervix, vagina, vulva: immature, insufficient dilation, fibrosis, disease, neoplasia, developmental anomaly.
Psychologic.

Aetiology: Foetal origin
Foetal oversize: breed, small litter size,
Developmental anomaly (e.g. anasarca).
Foetal position: ventral (dorsopubic), lateral (dorsolateral).
Foetal posture posterior: hock flexion, hip flexion.
Foetal posture anterior: head flexion, shoulder/elbow flexion.
Foetal presentation: transverse/bicornual, simultaneous.
Foetal abnormality: breed associated, random, foetal death

What do we want to know in late pregnancy?
1. Is the pregnancy healthy?
   - Clinical exam and sonography will tell us
2. How many pups is she going to have?
   - Radiology will approximate a litter size only at term and not with a large litter size
   - Sonography will do as well at 28 days
3. Can she have the pups vaginally?
   - No method will tell us
   - Radiographs with pelvimetry are not practical or reliable
   - Signalment is helpful – old, sick, brachycephalic, orthopaedic disease, singleton pup, large litter, hypothyroidism - might suggest an inability to deliver vaginally, but no method is definitive.
When is the end of pregnancy?
1. The end of pregnancy is 63 to 66 d from the LH peak, coincident with the progesterone rise, and so predictable from oestrus progesterone data.
2. Counting days from breeding is a very rough guide – a bitch can whelp 57 to 72 d from any breeding.
3. Sonography at 30 days can provide similar accuracy to oestrus progesterone data for estimating parturition. Sonographic parameters include:
   - Extra-foetal: ICC (inner diameter of chorionic cavity), Outer uterine diameter of implantation sites, Placental Thickness, Placental Length
   - Foetal: Biparietal Diameter, Crown-Rump Length, Body Diameter, Foetal Heart Diameter
4. Gaia Luvoni has published tables for standards of sonography measurements. She showed a gradual decrease of accuracy of prediction from week 4-5 to the end of pregnancy, so that accuracy +/- 1 day between predicted and actual parturition date was 81% at 4 weeks, 68% at 5 weeks and 51% at 9 weeks.
5. Even with good oestrus progesterone and sonography data there is still a normal distribution of pregnancy lengths.
6. Vicki Myer-Wallen in 2003 found that overall accuracy using oestrus progesterone for predicting parturition was:
   - 67% for day 65 +/- 1 day
   - 90% for day 65 +/- 2 days
   - And similar results for ultrasound measurements

Patterns of pregnancy
There are predictable patterns that can influence pregnancy length. Bruce Eilts (from LSU in 2002), our group and the group at Uppsala all showed that breed, parity and litter size all affect pregnancy length. Recently we published the population statistics of 510 dystocias that resulted in Caesarians. As a generalization we found that larger breeds, increasing parity and bigger litters resulted in shorter pregnancy.

As very specific example, the Uppsala group examined data from about 3,000 litters of Drever dogs in Sweden and found litter size was negatively correlated with pregnancy length, with each extra pup causing a reduced pregnancy length of 0.25 days. Some other researchers have found no effect of breed or parity on pregnancy length.

What if we don’t have predictive oestrus progesterone of ultrasound data?
At the end of pregnancy, the bitch enters Stage I labour within 24 hours of progesterone reaching basal levels. Progesterone is thermogenic – its fall is accompanied by a fall in rectal T of up to 1C. Temperature is equivocal – not all bitches show a temp drop and it may not be noted by all owners.

Maeder and co-workers in 2012 showed using continuous temp monitoring of the vagina that its transient, might be as low as 0.3C and might not occur in all bitches. Progesterone falls and stay down and is definitive and temperature falls and rises again and is less definitive.

Research
There have been 4 large scale studies of dystocia:
- Two retrospective studies of medical and surgical management in JAAHA and JSAP 20 years ago - Gaudet (JAAHA 1985) 128 cases and Walett Darvelid and Linde-Forsberg (JSAP 1994) 182 cases.
- Paula Moon from Cornell (JAVMA 1998) 808 bitches undergoing C-section from multiple hospitals in USA and Canada – examines signalment, perioperative management and mortality.
• Ayres and Thomas (Clinical Theriogenology 2010) 510 dystocias that resulted in Caesarean.

When to look: Indicators for examining a bitch for dystocia
Five to six percent of canine pregnancies result in dystocia. Numerous risk factors have been proposed by numerous authors, but there are very few actual data to link the risk factors to incidence of actual dystocia. In our study, we found, corrected for the population, brachycephalic (44%) were over-represented; small breeds were under-represented and large breeds over-represented; median age was 4 and mode was 2 years and 54% were maidens.
1. If the owner is worried, we should be worried
2. If the bitch is systemically ill there’s usually a bad problem
3. Once Stage II Labour has begun we want
   • Pup within 2 hours
   • Pup every 2 hours
   • Pup within 20 minutes of constant abdominal contractions
We showed that in 73% of dystocia cases the owners presented for perceived abnormality in the progression of labour of which:
• 1 in 3 were failure to begin Stage II Labour
• 1 in 2 had prolonged Stage II Labour without pup delivery
• 1 in 5 had cessation of Active Labour

Monitoring tools for labour
1. Temperature, pulse, respiratory rate, mucous membranes, chest auscultation, abdominal palpation, rectal exam, vaginal exam, mammary exam. In our study:
   a. There was at least 1 vaginal abnormality in 11% of bitches
   b. 18% had at least 1 uterine abnormality at surgery
   c. Only 13% showed intact Ferguson Reflex
   d. 7% had vomiting and 3% had ventral oedema
2. Basic bloods: pcv/TP, Blood Gas, Electrolytes, Ca, Glucose
3. Blood progesterone if we thought she was at term but there was no evidence of labour
4. Toocodynamometry involves a belt around the bitch’s abdomen which contains a sensor measuring frequency, strength and duration of abdominal contractions. This is extrapolated from human medicine. The evidence in dogs is partly proprietary and being accumulated
5. The only purpose of radiology is to confirm that pregnancy is finished or find rare abnormalities like gas in the uterus or pup in transverse presentation.
6. Sonography
   a. In 1988 it was demonstrated that foetal bradycardia was an early sign of foetal hypoxia (Monheit and co-workers).
   b. We know that normal foetal HR about 200-220bpm and normal Beagles at term have heart rates at least twice maternal rate.
   c. Deceleration might be transient or sustained with transient accelerations occurring with normal foetal movement.

When should I intervene?
These are definitive intervention parameters:
1. Obstruction
2. Bitch is systemically sick
3. If P4<6nmol/L and there is no labour
4. U/sound
   • Deceleration of foetal heart rate is an early sign of foetal hypoxia
   • Heart rate less than 180 bpm requires investigation and possibly intervention
5. Opinions vary about how low HR must be to warrant emergency intervention with no data relating foetal heart rates to individual pups outcomes. Less than 180bpm is believed to indicate some degree of foetal distress. Rapid intervention is believed to reduce foetal mortality. In our data, heart rates were as follows:
- 25% had at least one pup with normal HR
- 12% had at least one pup with HR=0
- 2% of cases had both normal and 0 heart rates
- 96% had at least one non-zero HR, of these in 78% of cases the HR was 180 or less, the median was 160 and the mode was 160bpm with range 40-300

Classification
We were unsatisfied with the lists of diagnoses of dystocia which are largely extrapolated from large animals especially cows. We published a proposal to classify canine dystocia in two ways – the presentation and the aetiology – the latter sometimes only verifiable after intervention. Most dystocia can be classified into these presentations. Often a true aetiology is not determined, or is diagnosed after the fact.

Classification
1. Failure to Begin Stage II Labour
2. Cessation of Stage II Labour Before Completion
3. Prolonged Unproductive Stage II Labour
4. Apparently Normal Stage II Labour with Foetal Distress

Aetiology
1. Maternal
2. Foetal

We classified 497 cases of dystocia that went to Caesarean. Dystocia was maternal origin in 13% of cases, foetal in 37% of cases and attributed to very large or small litters in 17% of cases. About 1/3rd we could not attribute a clear diagnosis even after surgery (idiopathic). Few of these cases would have been appropriate for medical management including oxytocin treatment.

Medical management
Induction of parturition is hard to justify – protocols have been developed which include combinations of progesterone receptor antagonists and prostaglandins (see the start of this paper), but they are accompanied by obstetric difficulties.

Ample data in human obstetrics illustrate that attempted and failed vaginal delivery, followed by Caesarean, has poorer outcomes for mother and baby than either approach alone.

Cesarean section is indicated if medical management is not likely to result in timely delivery of live pups. This can be a difficult judgment to make at initial presentation, but it is poor management, and likely to result in higher neonatal morbidity and mortality to attempt a vaginal delivery and to be forced into a Caesarean when vaginal delivery fails.

Rule out or correct obstructive disease. Correct fluid, acid/base and electrolyte abnormalities first and consider supplemental calcium gluconate and glucose. Calcium and glucose are often measurably normal – don’t expect much from giving them in isolation, although calcium may improve myometrial tone in the normocalcaemic bitch.
Uterine ecbolics are indicated in special circumstances only. Oxytocin is misused, with excess causing tetanic and unproductive uterine contractions, placental separation and fetal hypoxia.

Oxytocin is contraindicated for obstructive dystocia, closed cervix, fetal distress, systemic bitch illness, placental separation, uterine disease, uterine rupture.

Oxytocin stimulates smooth muscle contraction by increasing sodium permeability of uterine myofibrils. Oxytocin directly affects the rate of calcium ion influx into myofibrils so response to oxytocin is best if extracellular calcium concentration is normal.

Wheaten’s data support the use of oxytocin only at 1-5 IU SC or IM giving 20min duration of activity. She showed in 1989 that 1 unit of oxytocin was enough to cause intra-uterine pressure of >100mmHg.

An initial dose of 0.25 to 0.5 IU SC total per dog may be sufficient to induce adequate uterine contraction based on toco-dynamometry data. High doses - more than 5IU per dog may induce tetanic contractions of the myometrium.

Oxytocin causes a non-dilated cervix to contract. If oxytocin doesn’t work then medical management should cease. Repeated use is controversial.

There are some data on the use of oxytocin combined with toco-dynamometry which might allow more judicious use of oxytocin in future. Toco-dynamometry has been proposed to provide objective measurement of uterine contractions (by measuring intrauterine and intra-amniotic pressure) to prevent the use of oxytocin in the presence of normal, or hypertonic contractions.

Published success rates are modest. In the published literature <30% of appropriate candidates, when treated with oxytocin, completed parturition.

*Foetal viability* can be assessed with APGAR scoring and umbilical lactate as a measure of fetal acidosis.

**Caesarean**

Real data are scant. From our study (Ayers and Thomas) of Caesareans the median age was 4; brachycephalic breeds were overrepresented; 9% and 18% had vaginal and uterine abnormalities respectively; the modal lowest fetal HR=160bpm; mean litter size was 5.6 pups; pup mortality rate was 11.5%; aetiology was maternal 13.2%, fetal 37%, litter size 16.5%.

In 396 cases, pre-treatment with IV crystalloids and oxygen, no pre-medicant, induction with alfaxalone only and maintenance with isofluorane and oxygen resulted in no anaesthetic complications or bitch mortality. Will Lever has some unpublished data showing this anaesthetic regimen superior to induction with propofol and premedication with diazepam.

A single uterine incision at the base of one horn was sufficient to deliver all pups unless the litter was very big or diseased.

The Utrecht pattern was used in 418 patients, allowing closure of the uterus in a single layer without complications. Laura Heysom from our group has some preliminary data which suggest in bitches having repeat Caesareans, the Utrecht pattern in this location results in minimal adhesion development.
Intra-op and post-op antibiotics were not used and we had the following incidence of post-op disease: Metritis 1.3%; Hypocalcaemia 1.2%; Mastitis 1.8%; Wound Dehiscence 0.8%.

Repeat Caesarians result in reduced litter size of approximately one pup and are otherwise associated with no change to maternal or fetal mortality.

Propensity for Caesarian may be heritable (Thomas, unpublished data).

References


