When you are a scientific communication officer, one day or another, you will have to do lectures. I am not complaining here since, in my current position, this is something I really enjoy! It gives me the opportunity to connect with our clients and discuss their questions and concerns. No better way to stay in touch with the field!

When you lecture so often, you tend to become perfectionist. I now focus on many little details I really did not care about when I first started. In 2015, one I will particularly pay attention to: providing our attendees with written notes.

It makes total sense: our lectures usually contain lots of information and, as shown by several studies on human cognitive psychology, we only retain 10% of the content that was presented.

In the past I was sharing a copy of my slides but more and more, these only display pictures: no text, so hard to remember what the message was, especially when you review the slides few days or weeks after the event took place.

All my new presentations will now come with lecture notes in an e-book format. Here is the one from the talk I did during the 2015 International Working Dog Breeding Conference:

“**The neonatal period: also a challenge**

**in working dog breeding centers**”

As much as I like lecturing, I like writing even more. I hope this document will be helpful for you guys, and if you have any comment/idea on how to make the content part of our seminars even better, don’t hesitate to let me know, I’m always open to constructive suggestions! You’ll find my contact info at the end of this e-book! Good reading then!
Few days before preparing this talk, I had a conversation with a dog trainer in Ontario. When I told him I would be going to this conference to lecture on neonatology, he got really surprised. “Why would you lecture on this topic to these guys?” he told me. “This is something none of the attendees would be interested in. Nobody has time to breed working dogs, they are all bought through selected breeders.” I shared with him that, in fact, he was not entirely right and invited him to visit the resource section of the IWBDA website (http://iwdba.org/resources/) so he could see by himself. Some institutions/organizations do indeed have working dog breeding centers. Those are the direct application of the genetic selection program these structures implement.

I am sure you are well aware that rearing, training & maintaining a working dog is a long, sometimes very long process. Males and females that enter the breeding program are carefully selected based on pre-defined criteria. Breedings are decided based on “estimated breeding values”. No random decision there. Lots of effort is put into this work in order, ultimately, to improve the dogs’ performances in the field.

No doubt about that then: puppies that are born inside these breeding centers are therefore of very high genetic value. Give it some thoughts: what adjective would best characterize a newborn puppy? We could write down a very long list I am sure, but take a look at the ones I had in mind when preparing this talk. I am sure we will find some common ground here.

Whether they are born in a working dog breeding center or elsewhere, newborn puppies are fragile individuals. Anything that can be done to optimize their health will always be a plus. Let’s take a closer look at some of those things you need to focus on inside a breeding center.
Neonatology refers to the period that goes from birth to 2-3 weeks of age. Take a quick look at the table above; good, you now understand the challenge. All different studies that were done on the topic indeed concur: mortality rate indeed peaks during this period, averaging 20% of the newborns. In veterinary medicine and in herd health, this is considered quite high.

For a long time this was somehow seen as a fatality that could not be overcome. I have heard several times: “That’s the way it is, nothing we can do about it.” Good news: in 2015, that is not as true as it used to be. Veterinarians now have a better knowledge of the main factors that can impact the canine neonates’ health. Those can in fact be ranked in 3 main categories:

- Dystocias (= difficulties to give birth)
- Husbandry
- Infectious diseases

With this knowledge comes the possibility to better define preventative measures to therefore fight those consequences.

NB: You may have noticed that there is also a second peak occurring somewhere between 4-8 weeks of age. What happens at this lifestage (we would generally refer to it as “pediatrics”) is generally of different origin (very often infectious, very often parvovirus). That is often related to the progressive decrease of the concentration of the maternally-derived antibodies the puppies received right after birth by drinking the mother’s colostrum. We will not cover this part in our talk and will only focus here on the neonatal period, this period that again goes from birth to 2-3 weeks of age.
The picture above shows a pregnant Labrador bitch. I did not choose it randomly: Labradors are often considered as “easy whelpers”, and dystocia (=difficulties to give birth) and C-sections are usually not the norm. The reason I chose this picture is that because, even in this case, it will always be presumptuous to assert that “everything is gonna be fine”.

Canines are a polytocous species (=several offsprings). Anytime parturition occurs, as slight as it might be, there is always a risk. Just to give you an example I have dealt in the past with lineages of Labradors that seemed to be somehow predisposed to uterine inertia (= the uterus does not contract at the time of parturition). Had I stopped at the breed, we would not have been able to define the appropriate measures for those given bitches.

A study we did in 2007 on 1614 bitches showed that dystocia is not something uncommon in canines. In fact it concerned 13.7% of the canine deliveries. When this happens, prolonged expulsion of the foeto-placental units leads to hypoxia. Because of that lack of oxygen, blood modifications occur and create a state of metabolic acidosis (=the body produces excessive quantities of acid). Newborn puppies suffering from this disease often appear weak, lethargic and present orthopnea (=abnormal respiration pattern, like they were trying to swallow air at each breath).

In cases of dystocia, neonatal mortality rate peaked at 34.7% vs 10.7% in cases of eutocia (=normal birth). No need to do more maths here. It is crystal clear that in breeding centers, huge emphasis should be put in management of parturition.

Great news: there are simple things that can be done to achieve this.
Where to start? Well, in my opinion, it should always start well before parturition. Anticipation will always bring great benefits in those situations. Knowing when parturition is therefore supposed to take place is always a great pre-requisite. Any idea what the canine pregnancy length is?

If you go have a quick look, you will often be under the impression that canine gestation length is submitted to huge variations. Many books indeed state that pregnancy in canines last from 58 to 72 days. When I am said that, I always like to ask the question: ok, but from what? The answer is nearly always: from the first day of breeding.

This is where proper breeding management can make a whole difference. We can indeed be much more accurate in defining canine pregnancy length. This is achieved by taking the day of ovulation as the origin. That interval between ovulation and parturition in canines indeed equals 63 ± 1 days.

And determining the day of ovulation in breeding bitches is now something that can be performed in routine veterinary practice. To do that requires what we refer to as a timing of ovulation. The gold standard consists in performing progesterone assays during the bitch’s season. Canine ovaries start secreting progesterone before ovulation on the contrary to the other mammalian species, which therefore allow us to use this hormonal assay to detect ovulation.

For more information on timing of ovulation in canines, visit the following webpage http://royalcaninbreedersclub.ning.com/profiles/blogs/timing-of-ovulation-in-canines-3-take-away-messages-from-our.

Timing of ovulation allows us to detect the best breeding period and therefore optimizes fertility and prolificity. However, more than that, it helps us accurately predict the day of parturition, which is again in my opinion an essential pre-requisite to proper delivery management.
Over the years, veterinary medicine became even more precise. We indeed know that size plays a huge role in many biological mechanisms in canines. This is also true when it comes to pregnancy length.

Based on these results, we now consider that pregnancy length is:

- Approximately 62 ±1 days in small breeds (< 10 kg adult body weight)
- Approximately 63 ±1 days in medium and large breeds (10-40 kg adult body weight)
- Approximately 64 ±1 days in giant breeds (>40 kg adult body weight)
Next step to optimize parturition management in breeding centers: early detection of any risk factor that could impact the parturition’s outcome. This is also an area where veterinary medicine has made huge progress. Some of those factors that influence the occurrence of dystocia are indeed well identified:

- The breed: this one is less likely to apply to working dogs in my opinion, but always good to keep in mind. Because of their brachycephalic morphology (= large heads, small pelvis) English Bulldogs, French Bulldogs and similar breeds are usually overrepresented in the studies focusing on dystocia in the bitch. They are not the only ones however: 40% of Scottish Terriers bitches are said to suffer from primary uterine inertia, dystocias are also common in Chihuahuas and English Bull terriers. More than the breed and as I mentioned earlier, lineage sometimes seems to play a role as well and could therefore affect any breed.

- The weight: overweight has been described as a risk factor for dystocia in the bitch. If overweight/obese bitches are less likely to enter working dog breeding programs, one common mistake encountered in the field consists in feeding breeding bitches with a diet with higher energy density (like puppy food) since the beginning of pregnancy. It is important to keep in mind that during gestation, the foetuses will take 70% of their final weight during the last 20 days of gestation. Energy intake should therefore only be increased in that last third of pregnancy. When the bitches receive puppy food too early in gestation, the energy in excess is converted into fat that can consequently impact the strength of the uterine contractions. For more info on how to properly feed a pregnant bitch, please watch this video here http://royalcaninbreedersclub.ning.com/video/webinar-nutrition-of-the-pregnant-bitch-narrated2.

- The parity: primiparous bitches (=bitches giving birth for the first time) are often said to be more at risk. In fact, studies identified that this risk is significant when bitches are bred for the first time after 4 years of age. It is important therefore not to start their reproductive career too late in order to decrease the associated risk.
History of dystocia: the uterus quickly recovers from a C-section and if the surgical procedure was properly performed and no obvious abnormality was noticed at this time, there is generally no reason why the bitch would need another C-section at the following pregnancy.

I would also always recommend to precisely determine the size of the litter in a pregnant bitch. This parameter is indeed associated with occurrence of dystocia in the bitch.

The more accurate way to accurately determine the litter size in the bitch is by performing X-rays after 45 days of pregnancy. Before that, the foetuses’ skeletons are not calcified yet and are therefore not visible. Practically speaking we often recommend performing X-rays at 50 days post-ovulation, which will allow better visualization and evaluation. Two different views (lateral and ventral views) should always be taken for better appreciation. On the other hand, ultrasounds are NOT an accurate technique to precisely determine the litter size. Ultrasounds indeed only allows to observe sections of the abdomen and in case of larger litters, it is somehow easy to miss a puppy or count one twice. Don’t get me wrong, it is a great tool to assess vitality of the foetuses, but in terms of litter size, it will only give you an estimate.

The “single puppy syndrome” (or “small litter syndrome”) consists in one or two puppies in a large-size bitch. It is frequently associated with dystocias, stillbirths and C-sections, because of a lack/absence of uterine contractions. When the puppy is of high genetic value, an elective C-section can be proposed to optimize the neonatal survival rate.

Same kind of situation can be observed in what is often referred as “hyperfoetation”. Very large litters (>12 puppies) lead to an overstretched uterus that is again not able to properly contract during parturition. In large litters, it is not uncommon to observe more stillbirths, especially the last puppies that are expelled.
It appears essential to assess those aforementioned risk factors during pregnancy in the bitch. This helps a great deal anticipate the occurrence of dystocias. If the risk seems high, proper approach can be then undertaken to optimize the survival rate of the foetuses. Elective C-section is definitely a great tool for this purpose.

Elective C-sections indeed present multiple advantages:

- It is performed during the day, while complete veterinary staff is available. When we were doing those surgical procedures, we always had two surgeons, 1 anesthesiologist (the most important role when doing a C-section) and a full team for puppy resuscitation. This is a real plus since on the contrary, emergency cases often happen at night (2 bitches out of 3 will give birth in the middle of the night) while veterinary staff is limited.
- It is performed before the bitch has started to deliver: no foetal stress yet, no need to rush the procedure. This decreases the related stress on both the patients and the veterinary team.
- Studies show that when all conditions are met, neonatal survival rate is excellent. Check above the neonatal mortality rate we obtained in that study we did in 2007. In comparison, neonatal mortality rates between 20-40% are reported when dealing with emergency C-sections.

The scheduling of the elective C-section is critical, and definitely easier when a timing of ovulation has been performed during the bitch’s season. In our study we were performing the C-section 61 days post-ovulation. For more technical details, please refer to the aforementioned study http://www.ncbi.nlm.nih.gov/pubmed/19754563
If no specific risk factor has been identified, it is still important to properly monitor what is going on during parturition. Again, remember that it is nearly impossible to predict how things will go in a polytocous species.

Some bitches will seek human assistance, some might not, always hard to tell. If you are under the impression that your presence might stress out the animal, don’t hesitate to use a webcam to keep an eye on what is happening. It is always hard to say what is normal and what is not when it comes to parturition. You can watch this video here to learn the basics [http://royalcaninbreedersclub.ning.com/profiles/blogs/canine-reproduction-episode-ii-from-mating-to-parturition](http://royalcaninbreedersclub.ning.com/profiles/blogs/canine-reproduction-episode-ii-from-mating-to-parturition) but remember huge variability exists between bitches, and even between deliveries. One rule of a thumb however: if you are under the impression that something goes wrong, don’t hesitate and ask for veterinary assistance.

Stress is often a concern in breeding centers, especially in primiparous bitches. A stressful bitch can indeed totally block her uterine contractions, and you are now well aware of the subsequent consequences. Introducing the bitch to the maternity one week before her due date is always a good way to familiarize herself with this new environment. Some veterinarians also recommend the use of pheromone collars (DAP®, Adaptil®,… ) when the bitch enters the maternity. Nutritional solutions that helps better cope with the side effects of stress exist as well but might not however fulfill the nutritional requirements of a bitch at this stage of gestation.

In case you have to help the parturient bitch, neonatal resuscitation is critical. You will find essential information on our blog post here [http://royalcaninbreedersclub.ning.com/profiles/blogs/shaken-puppy-kitten-syndrom-how-it-can-be-prevented](http://royalcaninbreedersclub.ning.com/profiles/blogs/shaken-puppy-kitten-syndrom-how-it-can-be-prevented), especially on the “Shaken Puppy Syndrom”. I think it is however important to spend a bit more time on the APGAR scores we mentioned during our talk.

In the field of neonatology, there are figures that must be known because of the huge contribution they brought to this field. Virginia Apgar (1909-1974) is one of those giants, and her work is something that profoundly changed the way we approach neonatology.

Virginia Apgar was an American obstetrical anesthesiologist. She was a leader in the fields of anesthesiology and teratology, and introduced obstetrical considerations to the established field of neonatology. To the public, however, she is best known as the inventor of the Apgar score, a way to quickly assess the health of newborn children immediately after birth.

The Apgar scale is determined by evaluating the newborn baby on five simple criteria on a scale from zero to two, then summing up the five values thus obtained. The resulting Apgar score ranges from zero to 10. The five criteria are summarized using words chosen to form a backronym (as you can see on the slide above):

- **Appearance**: refers to the natural color, texture, and appearance of the skin, especially that of the face;
- **Pulse**: = heart rate
- **Grimace**: = reflex irritability; a reflex action is an involuntary and nearly instantaneous movement in response to a stimulus;
- **Activity**: flexion/extension of the arms and legs;
- **Respiration:** = respiratory effort and frequency.

The Apgar scores are routinely used in human maternities, but if I mention them in this ebook, it is simply because they have also been adapted to veterinary medicine for our companion animals.

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The table above tells you how to use these Apgar scores for newborn puppies. This can be a quick, easy and definitely more objective way to determine their health status right after birth and quickly decide if medical support will be required or not.
After management of parturition, proper husbandry is the second essential requirement in order to better protect the neonates. I am often asked what tools are essential to have inside a maternity. To make it super-short, had I to pick the strict minimum, there would be only two things I would pick.

- A thermometer: Newborn puppies usually have a body temperature around 35-36°C while our adult dogs are usually around 38-39°C. There is a bit of a difference here, and you see that it is therefore easy to believe that a puppy is hypothermic, while it is in fact not the case. One rule of a thumb then: always have a thermometer on hand when you perform a clinical exam in newborns. I am also always asked if it is better to use a rectal or an auricular thermometer in these cases. I always used the rectal one, but studies showed that both are accurate in dogs and cats.

- And a scale: rule of thumb, a healthy puppy gains weight on a daily basis. They can lose up to 10% of their birth weight the day after birth, generally following expulsion of the meconium (= the first stools of the puppy), but then they should always gain weight. If they do a plateau or lose weight, that could be a preliminary sign of sickness. Maybe the puppy is too small, too weak to access the mammary glands. Maybe it is suffering from a bacterial infection. Whichever the situation is, very often weight loss is the first clinical sign that will be observed. Monitoring the puppies’ weight on a daily basis is therefore essential.

Now that you have the tools, you need to know what to focus on: this is time to focus on what we refer to as the 3-H syndrome: Hypothermia / Hypoglycaemia & Dehydration.
The first H- we will focus on is Hypothermia. I already told you that newborn puppies have a lower body temperature than what is usually encountered in their adult counterparts.

There is however something more to it: newborn puppies are unable to regulate their body temperature by themselves during their first 3 weeks of life. Unlike adults that will shiver in order to increase their body temperature if they are cold, newborn puppies do not have this protection mechanism. If they are cold, they will unfortunately get colder… which obviously has lots of consequences.

When they are hypothermic they become less active. In the case of puppies with their mothers, this will definitely impact their ability to nurse. If their body temperature drops below 34ºC, digestive transit will then stop. That is something extremely important to keep in mind since very often, when a puppy seems unhealthy, the first reflex we have is often to try to feed them (via bottle-feeding or tube-feeding eventually). That is a mistake: in newborn puppies “that are not doing well”, the first reflex should be to check their body temperature.

If you try to feed a hypothermic newborn, milk will accumulate in its stomach, it will bloat and eventually lead to false aspiration. Definitely not the best: at this early age, they are not able to properly eliminate the liquid that gets in their lungs and they therefore have more risks to develop a fatal bronchopneumonia… Keep in mind that they will only lose their suckling reflex (=when you put your finger in their mouth, they will automatically suckle it) only when body temperature drops below 32ºC. So they might still suckle, while they are no more able to digest.
There are different ways to warm up a cold puppy, but whatever happens, keep one thing in mind: it has to be progressive. The warming up should take place over an hour-and-a-half/ two hours period to avoid severe consequences on the cardiovascular system.

Different techniques exist (infra-red heat lamps, hot water bottles, incubators,…). I do have a preference for the heat lamps since it will create of cone of heat around which newborns can crawl to find their thermic comfort zone. I do also like a lot incubators like the one shown on the picture above, that will allow you to control temperature as well as humidity.

In terms of prevention, you need to focus on the temperature inside the nest. We recommend:

- 30°C during the first week of life
- 28°C during the second week
- 25°C during the third week

A weather station is a great way to monitor that you reach those optimal temperatures in the center of the nest.

Practical tip: always make sure the puppy is perfectly dry before warming it up. If this is not the case and you put it under a heat lamp, the energy required for evaporation of the water present on its coat will be taken from the puppy itself. So instead of warming it up, you will initially decrease its body temperature. By drying it up before, this will prevent this potential side-effect.
Let’s now focus on Dehydration and Hypoglycaemia. Newborn puppies only have few energy reserves at birth, and those reserves are the direct reflection on how their mother was fed during pregnancy. Following a proper feeding management in the bitch during gestation as we mentioned earlier is therefore key. Feeding management of the mother during lactation is also important. Milk production requires huge amount of energy and this is why it is generally recommend to feed the bitch ad-libitum at this stage with an energy-dense diet. This is the only lifestage where such a recommendation is made in the bitch. If this is not the case, milk quality and ultimately milk production can be impacted, with obvious repercussions on the newborn puppies.

Clinical symptoms related to neonatal hypoglycaemia vary a lot: lethargy, weakness, seizures, dehydration, secondary hypothermia...

How to assess dehydration? In adult dogs and cats, we often check the skin fold to check the hydration status of the animal. This will unfortunately not work in newborn puppies and kittens: if we refer to this technique, we would think that nearly all of them are dehydrated!

There are two ways to assess the hydration status in newborn puppies/kittens:

- Check the gums: if they are dehydrated, the newborn’s gums will definitely feel dry;
- Check the urine density of the newborns: in newborns, urine is isosthenuric (density between 1.008 and 1.012) since their capacity to concentrate the urine is limited.

The best way to regulate the newborn’s glycaemia and fight dehydration is definitely through feeding. When they are nursing on their mother, newborns will usually take 12-20 meals per day. Worst case scenario, if the mother has no milk or if the puppies are not properly gaining weight, bottle-feeding will need to be initiated.

It is usually recommended to give:
- 8 meals/day (so 1 meal every 3 hours) during the first week of life
- 6 meals/day during the 2\textsuperscript{nd} week
- 4 meals/day during the 3\textsuperscript{rd} week

Practical thing to remember: newborn puppies cannot defecate/urinate by themselves. This is a reflex that is usually triggered by the mother licking their perineal area. If you have to bottle-feed, to prevent constipation from happening, you will need to stimulate the perineum of puppies and kittens right after feeding them with tepid water-moistened gauze. They should typically defecate after each meal.

2/ What's with Dehydration / Hypoglycaemia?

In case you need to act in order to prevent the consequences of dehydration & hypoglycaemia, as we just mentioned bottle-feeding will definitely be the first option to consider. The position of the puppy is important and should be as shown on the picture above. Sometimes people want to bottle-feed these newborns like we would do for baby humans. Don’t! This will increase the risks of false aspiration. Also use a dedicated bottle AND nipple. If you use a human one, the milk flow might be too important for tiny newborns and if they drink too much too fast, again there is a high risk of false aspiration.

If the puppies are really weak, after warming them up of course, tube-feeding can be considered. Don’t hesitate to ask your veterinarian to show you how to do this. It is a very simple technique, way less scary than one might think, that can definitely come in handy when dealing with these cases. Here is a link to a great Youtube video that can give you some ideas as well http://youtu.be/JbX4mk291Pc.

Something critical as well: always use a dedicated canine milk replacer. When I arrived in Canada few years ago I attended to a seminar on canine neonatology and the speaker was telling us that puppies “don’t thrive when fed milk replacers”. I was definitely surprised since this was really far away from the experience I had in practice.
Frequently also, I hear/read about the fact that “goat milk is the best alternative for newborn puppies.” That might have been the case in the past, maybe, but we have now a whole body of scientific literature showing that goat milk is way different than the canine one. I wrote a blog post on the topic a couple of years ago, don’t hesitate to refer to it http://royalcaninbreedersclub.ning.com/profiles/blogs/myth-busters-why-goat-milk-is-no-more-a-valuable-alternative.

This is a topic I discussed a lot on my blog so do not hesitate to read the following posts that will provide you with more elements:


In the last part of this talk, we will now focus on how infectious diseases can as well impact the health of newborn puppies. When dealing with a puppy that seems sick indeed, it is always important to keep infectious diseases in the corner of your mind, since they are believed to be one of the most common causes of neonatal mortality during the first weeks of life.

When we think of pathogens, we always have to separate them between specific and non-specific ones. The list of specific pathogens that can cause neonatal mortality could go on and on: *Brucella canis* (its importance really depends on the epidemiological situation of the country, but it is always important to check for this disease whenever you deal with a reproductive situation); Canine Herpes Virus Type 1 (CHV-1 is mentioned in all textbooks of canine reproduction as a causative agent of neonatal mortality, but recent studies show that its impact is way lower than what is thought in the field); *Leptospira*; *Distemper Virus*; Parvovirus Type 1 (Minute Virus); *Leptospira* sp; *Mycoplasmas*; *Neospora caninum*; *Toxoplasma gondii*; *Leishmania* sp... As you can see we could go on and on with these specific diseases. Unfortunately today, nobody can tell for sure today what their importance is when it comes to canine neonatal mortality.

Non-specific pathogens, essentially bacteria, seem to be more commonly involved in this syndrome. *E. coli* seems to be the predominant one, but others like *Staphylococcus aureus*, *Staphylococcus pseudointermedius*, *Streptococcus canis*, *Streptococcus dysgalactie subsp equisimilis*, *Streptococcus equi subsp zooepidermicus*, *Klebsiella pneumonia*, *Proteus mirabilis* and *Pseudomonas aeruginosa* have also been reported.

Infectious diseases can therefore be an issue: fortunately here again, there are things that can be done to help the neonates better fight those threats.
From a clinical standpoint only it is not always obvious to point out that there is an infectious disease at play. Weight loss is often the first symptom that will show up, and sometimes, apart from that puppies seem perfectly healthy. That is another reason why it is so important to monitor it in every puppy born at the breeding center, and this has to be done on a daily basis.

Other clinical signs that can be observed are:

- Lethargy
- Weakness
- Failure to nurse
- Crying more frequently
- White stools
- Neonatal diarrhea, ophtalmia, skin infection

More information on neonatal diarrhea in newborn puppies here

Infections of the umbilical cord are of particular interest. Those are indeed a frequent cause of neonatal morbidity in newborn mammals. In many species – humans included-, a sick newborn will undergo ultrasounds examination of the umbilical area to rule out umbilical abcesses. This is usually not done in routine in canines but with linear probes of high frequency (12-14 Mhz) becoming more frequent in veterinary medicine, this might not be easier to check and ultrasounds might play a huge role in the future of neonatology.
The first thing you can do to better protect the newborn is to take proper care of their umbilical cord right after birth. Indeed, the umbilical cord contains blood vessels that directly connect the inside of the abdominal cavity with the outside environment, and represents a direct access for the bacteria of the environment.

It is therefore important to properly disinfect its terminal end on a regular basis (2-3 times a day) with an antiseptic solution (Betadine, Chlorehexidine,...) until it falls down. This simple measure is often overlooked, but this should be done all the time, even when the mother cut the umbilical cord herself. If you think about it, there are lots of germs in the oral cavity of canines, and therefore there is always a risk, especially if oral health is a concern.

On a side note, oral health should always be on the list of things to focus on in breeding bitches. Tartar accumulation and other dental diseases can lead to the presence of a high amount of bacteria in the oral cavity that can eventually be transmitted to the newborns via licking or cutting the umbilical cord right after birth.
Colostrum intake is the second priority in order to better protect the puppies against infectious diseases. Newborn puppies at birth are indeed said to be agammaglobulinemic (=means they have nearly no immunity since very few antibodies cross the placental barrier during gestation). They will receive their first immune system by suckling the colostrum, this first milk of the mother which is enriched in antibodies.

Colostrum has in fact two roles: it brings immunity to the newborn puppies, but it also acts as an energy booster that is essential for the puppies right after parturition. Colostrum is usually produced in the 24hours after the onset of lactation (and not necessarily 24h after birth). As you know, certain bitches start producing milk sometimes a week before delivering. There is no evidence that the colostrum quality remains the same at birth in these situations. In other species, there are ways to estimate the colostrum quality by measuring its concentration in antibodies. In canines however, this cannot currently be done in routine veterinary practice. Best way to assess it remains to focus on its color. Colostrum is usually yellowish, while milk will be white, as you can see on the picture above.

One alternative if the bitch start producing colostrum way before birth is to collect it and bank it in aliquots in the freezer. After warming it up using a water bath (no microwaves, this will destroy the antibodies it contains), it could be bottle-fed to newborn puppies at the reason of 1-5ml/100g body weight.
For an optimal level of antibodies of the colostrum to be absorbed at the intestinal level in the newborn puppies, timing does matters. In the past, we used to say that colostrum can be absorbed during the first 24 hours after birth, but were not being more specific.

The graph from a study presented in 2012 gives us a better understanding of how critical it is to administer it as quickly as possible after birth. Look at the sharp decrease in colostrum absorption that is observed 4h after birth.

In a breeding center, there might be times when the delivering bitch is not lactating at all. What are the alternatives then? In other species, they have access to colostrum banks or colostrum substitutes that could be used as replacers. That is unfortunately not the case in canines, unless you bank the colostrum of your own bitches as we wrote earlier.

Administering subcutaneously or orally serum of healthy adults has been proposed as an alternative in the past in puppies deprived of colostrum. This was not a very practical solution in the past since huge quantities of blood had to be drawn. Recent studies however pointed out that puppies receiving serum had no increase in antibody blood levels compared to puppies not receiving colostrum at all. It can still provide local immunity at the level of the digestive tract, but it now seems that it will not provide the systemic immunity puppies receive from colostrum.

On a side note, it is possible in puppies to evaluate colostrum intake by assaying the ALP blood levels during the first week of life. This enzyme is indeed contained in the colostrum, and puppies receiving it will have very high levels of this enzyme in their blood.

If puppies cannot receive the colostrum, keep in mind that the second role of colostrum is to act as an energy booster. A dedicated canine milk replacer will definitely do the trick here. Puppies that did not receive the colostrum might benefit from a different vaccination protocol, and it is sometimes recommended to start vaccinating them earlier, at 4 weeks of age.
Bacterial contamination can occur in newborn puppies via the mother, and one of the major route of transmission is eventually the milk. Mammary gland health is indeed something to monitor closely in lactating bitches. Mastitis is indeed a complication that can always happen.

From a clinical standpoint, mastitis often means red, hot and painful mammary gland(s). Abdominal mammary glands, which produce more milk, are often the ones that are affected. It is therefore recommended to palpate and examine the mammary glands daily. Milk secretion should be checked as well since in cases of mastitis it is often modified and will present a brownish to red color. This is important to check since sometimes, only color modification will be observed.

Bitches suffering from mastitis may not allow puppies to nurse, or even be hyperthermic in acute cases.

We could have a talk only on mastitis in bitches but here are some key points for preventing their occurrence:

- Daily monitoring as mentioned above
- Cutting the nails of the puppies as they grow, since these can often irritate the mammary glands and therefore favor the penetration of germs in the mammary gland parenchyma.
- In case you notice mammary gland irritation, you can apply lanolin on them. Lanolin is a yellow waxy substance secreted by the sebaceous glands of wool-bearing animals and is frequently used in breast-feeding women suffering from sore nipples for its skin-protection properties.
Environmental contamination is definitely an important route of neonatal infection. That is why the hygiene of the maternity should always remain a priority in working dog breeding centers. As I often say, nobody likes to scoop the poop but this is definitely the cornerstone of the kennel hygiene.

We wrote several blog posts on these topics that you can read here, these were initially meant for shelters but same sanitation concepts can apply in breeding kennels:

http://royalcaninshelterprogram.ning.com/profiles/blogs/cleaning-vs-disinfecting-why-your-shelter-staff-needs-to-know-the


http://royalcaninshelterprogram.ning.com/profiles/blogs/a-lot-of-hygiene-and-a-glimpse-of-contraception-this-was-our

http://royalcaninshelterprogram.ning.com/profiles/blogs/msds-what-the-heck


One thing that definitely makes it easier is the way the maternity is built. Materials used must be easy to clean and disinfect in order to maximize the benefits of the sanitation protocol. Lots of alternative are available on the market, but if you are looking for ideas or are just curious, I would definitely recommend you to visit Pinterest www.pinterest.com and search for “dog whelping boxes” and “dog maternity”. I am sure it will give you lots of great ideas on how to set up your
You understood that neonates are fragile and that many things can impact their health, and this even well before they are actually born. Rule of a thumb: always be prepared! That is the best way to optimize the newborns’ health and give them their best shot while arriving in this world.

There are three essential axes to focus on:

- Management of parturition: remember what studies say, dystocia is associated with a 37.4% neonatal mortality rate. Some situations can be prevented well before they happen because of detection of evident risk factors. Always keeping an eye on the parturient bitch will allow you to act faster in the event of an emergency as well.
- Husbandry: certainly not something to overlook for sure. The 3-H syndrome is a reality and easy steps like controlling the nest’s temperature and daily monitoring of the puppies’ health will definitely help you detect at-risk situations and treat them accordingly.
- Infectious diseases should always be kept in mind: specific causes do exist, but non-specific causes of infections seem to be way more common in our experience. Care of the umbilical cord and ensuring that the puppies receive the colostrum are always important first steps. Then monitoring the health of the mammary glands and ensuring optimal sanitation of the maternity will definitely optimize the life conditions of these neonates.

This is the end of our presentation and I hope you learned a few things that will help you on your day to day activities at the breeding center. I hope this document was helpful, as usual do not hesitate if you have any question or comments, feel free to contact me and send me your questions, I’ll be glad to help if I can!
Thank you for your attention!

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www.linkedin.com/in/emmanuelfontaine

www.facebook.com/emmanuel.fontaine.758

www.twitter.com/DrEFontaine

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Suggested readings


Mila H.; Chastant-Maillard S., 2014: The first two days of life of puppies: crucial steps for survival. 17th EVSSAR Congress. Wroclaw, Poland, pp. 127-130.


