



Notes about Intra-Uterine Insemination (IU-AI) in Sows

Definition

Delivering semen directly inside the *Corpus uteri* using a special AI-Catheter.

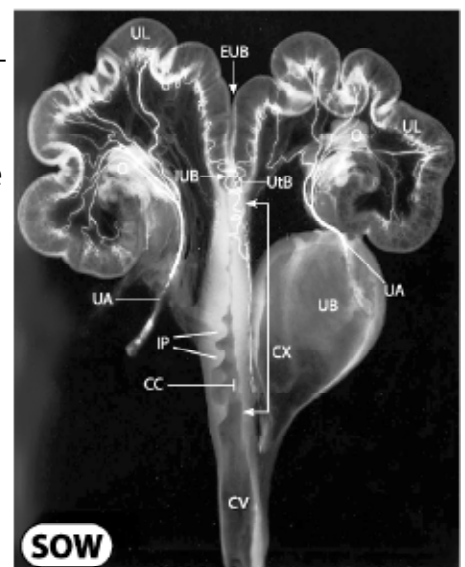
Supposed and real advantages

1. Reduction of sperm number per AI-dose
2. Better yield of high genetic value boars
3. Better results with frozen semen
4. Minimal reflux of semen during and after insemination
5. Lower volume of semen dose
6. Less time needed for AI

but it is important to take into account, that:

1. Reduction of sperm numbers per AI-dose

- If sperm numbers are reduced, quality of semen has to be optimal.
 - Less spermatozoa per dose ⇒ more control of semen quality. Inseminating with a low concentrated spermatozoa/dose (1 billion/dose), demands higher requirements in vitality (progressive movement) and nd lower percentage of abnormal spermatozoa in the semen dose.
 - In spite of the nearer deposition of spermatozoa in the uterine corpus (20 cm) compared with the traditional AI, sperm cells have to advance across the uterine horns (between 80 and 130 cm length) to reach the point of fertilization.
 - The number of sperm cells decreases substantially during transport to the oviduct due to adherence and sticking of sperm cells to the uterine epithelium and the immunological attack of polymorphonuclear leucocytes the sperm cells are exposed to.
 - The minimum number of spermatozoa/dose for a high fertilization/farrowing rate will depend on the quality of the ejaculate, the preservation of the seminal dose, the quality of the dose at the time of insemination, the kind of extender and the application of the semen.
 - In order to maintain fertility and prolificacy parameters of the farm, it is recommended that concentration of sperm cells/dose be > 1 billion. CASA-Systems for quality evaluation of semen are high value tools for producing secure and good quality semen.



Senger, 2005

2. More intense utilization of boars

- Genetically high valued boars can breed a higher number of sows, improving significantly their use and genetic progress. The IU-AI may also be used as part of an emergency program for closed breeding systems, when semen production has to be stopped in an AI-Center and all sows are to be bred with semen of remaining centers.
- To optimize productivity of boars selected for IU-AI, quality and security in the semen production are keys, beginning with the (auto-mated) collection, quality evaluation (CASA-Systems), dilution (superior quality extenders), (automatic) packing and transport under controlled conditions.

3. Better results with frozen semen

- Recent studies (Casas et al, 2009) indicate that IU-AI can substantially improve fertility for frozen/thawed semen. Results of fertility can be doubled with IU-AI by the use of thawed semen previously selected (with >50% motility and >45% viability).
- Kaeoketu, 2010 defines volume and concentration of thawed semen for IU-AI as 60 ml and 2×10^9 sperm cells respectively.

4. Minimum reflux during and after IU-AI

- Reflux for semen during AI is a common fact that doesn't depend on the site where semen is deposited, and is not related to reproductive problems (Steverink et al, 1998; Rath, 2002).
- The reflux of semen during or immediately after AI has been considered by many technicians as a critical point of the AI technique. Some studies about it suggest that the reflux is of minor importance (Steverink et al., 1998). According to these authors, the liquid reflux occurs in all inseminations as a normal mechanism of uterine defense. In 66% of sows, reflux is observed within the first 5 minutes after AI. The volume lost in this period contains the exact amount of sperm cells that can be supposed:
 - If a sow has been inseminated with 70 ml of semen containing 3×10^9 spermatozoa, and within the first five minutes there is a reflux of 5 ml, there are lost $[5 / 70 \times (3 \times 10^9)] = 0.2 \times 10^9$ sperm cells.
 - Therefore, if a high volume is lost during the first 5 minutes, there is a reason to be worried; otherwise a small volume is less important.
 - The genital tract of the sow is very efficient in transporting spermatozoa to the oviduct within the first 30 minutes after AI. This occurs in 98% of all the AI's and for this reason, every ml of liquid lost as time passes will contain fewer sperm cells
- Applying traditional AI, usually reflux is minimized by improvement of AI-technique (heat detection, fixation of catheter, stimulation of the sow before and after applying semen)
- The lost of liquid within 3 hours after AI may reach 70% or the inseminated liquid. But it must be clear that sperm cells already colonize the sperm reservoir at the uterus-tubal junction 30 minutes after AI. Therefore it is more important to assure the quickest transport of sperm cell to the oviduct. The destination of the transport medium – the liquid itself – doesn't influence the result. Therefore, the immediate reflux after AI is important; its value decreases with the time passed after AI.
- An incorrect performance of IU-AI will conduce to insufficient reserves of sperm cells to breed a sow or to produce a good litter. This could explain the variable results of IU-AI.

5. Lower volume of the semen dose

- Reducing the volume of a seminal dose isn't an advantage by itself. The use of a volume of 30 ml for the IU-AI was ultimately only the result of splitting the semen dose processed for traditional inseminations.
- The volume of the semen dose is the key for the transport of sperm cells through the cervix ⇔ uterine body ⇔ uterine horns ⇔ oviduct. A minimum semen volume is necessary to assure contractions of the uterine muscular tissue to allow the sperm migration through cervix (15-25 cm length), uterine body (6-15 cm length), uterine horns (80-130 cm length), to finally reach the oviduct (15-30 cm length)
- The uterine body splits the sperm cells to both uterine horns; therefore a certain volume of semen is needed to assure the entrance of a minimum of sperm cells in each uterine horn.
- To assure that IU-AI becomes a confident technique with ongoing satisfactory results, the volume of the semen dose must be above 50 ml.

6. Less time for AI after positioning the catheter

- Introduction of the catheter is more time demanding than using traditional AI.
- The post-cervical catheter is similar to the traditional catheter, but it contains inside a second longer and thinner catheter. The use of these catheters, as well as the IU-AI technique, is a little bit different to the traditional handling, making it absolutely necessary to train a technician before starting the method on the farm. The risk of injuries to the uterine cervix and other tissues is high when the technicians are not properly trained. A wrong use of this type of catheter increases the risk of infections of the sows.
- The traditional AI with the “free-hand system” is a more sure and rapid technique than the IU-AI. On well-organized farms, the AI of 40 sows/hour is a normal parameter.
- The qualities of the IU-AI catheters, as well as maximizing hygiene during its use are critical points to consider. It is recommended to use individually packed catheters, because they assure hygiene of the intra-uterine catheter during the process.

Conclusions

1. The seminal quality of the dose and its minimum content of sperm cells, in order to get a high fertility/farrowing rate with IU-AI, depends on the quality of the ejaculate, the semen processing, type of extender, storing of seminal doses, quality of semen at the time of insemination and the insemination itself.
2. To maintain the fertility and littering parameter of the farm, when using IU-AI, it is recommended that the concentration of spermatozoa be >1 billion/dose with a seminal volume of >50 ml.
3. To use IU-AI means higher requirements for the personnel, for those performing the AI, as well as for the others concerned with the production and transport of the semen doses for IU-AI.