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SUPERBABE

Wide-eyed Louise Brown pictured in hospital 18 hours after she was born. Today she's doing well. See Page Three

First 'test-tube baby'.

ALAMY

NEED TO KNOW

Counselling is imperative so that all invested parties are informed of the risks and responsibilities associated with donor conception.

Donor assisted conception is becoming increasingly common in assisted reproduction.

Indications for use of donor eggs and sperm are extensive.

Risks associated with donor assisted conception include physical, psychological and social risks; consider the risks to the donor, intended recipient(s) and the offspring.

Not all states and territories have guidelines on donor assisted reproduction and as such they follow the NHMRC guidelines.

Donor assisted conception must be altruistic.

Donor assisted conception is no longer anonymous and there are family limits to donation that are state based.

Ethical frameworks are important in donor assisted conception; human beings are not to be viewed as a commodity or saleable.

Egg and sperm donation

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This information was correct at the time of publication: 1 July 2022

DEFINITION

A gamete is defined as a mature haploid male or female germ cell that can unite with another of the opposite sex in sexual reproduction to form a zygote (see figures 1 and 2).[1] These germ cells are commonly referred to as either an egg (oocyte) or sperm.

Gamete donation refers to the process whereby an individual provides genetic material (a gamete) to a recipient or recipients, also known as third party donation or donor conception.

Embryo donation is 'double gamete donation' whereby both egg and sperm have already combined to form an embryo (see figure 3) and this composition of genetic material is given to the recipient or recipients.[2]

BACKGROUND

HUMAN oocyte and embryo donation was first successfully performed in 1983 (by Monash IVF); with the progression of assisted reproductive technology (ART) this has progressively become a more commonly utilised method of creating a family.[3]

Reportedly, almost 4% of women undergoing ART will utilise donor oocytes.[4] The Australia and New Zealand Assisted Reproduction Database indicated that in 2018 there were 3498 oocyte/embryo recipient cycles. Of these, 2950 (84.3%) were oocyte recipients and 548 (15.7%) were embryo recipients.[5] The average age of a woman undertaking an oocyte or embryo recipient cycle was 40.3.[5]

When the first child was conceived via sperm donation remains unclear, with variable reports dating back to the 1800s.[6] However, the first known pregnancy with donor insemination with frozen sperm is well documented, in 1953. The use of donor insemination has also increased over the years.

In 2018, there were 3262 donor sperm insemination cycles and the average age of a woman undertaking donor insemination was 34.5 years.[5]

This How to Treat covers oocyte and sperm donation and aims to ensure GPs can understand indications and processes for gamete donation including advantages and disadvantages.

Oocyte donation

Oocyte donation was first conceptualised for women with premature ovarian failure or early menopause. Many women with reproductive challenges can now seek an oocyte donor; the indications and reasons for a woman or couple wanting oocyte donation are extensive. Box 1 provides a summary of some of the indications.[7]

Who can be an oocyte donor?

A donor can either be known or unknown (from oocyte banking). The desirable medical attributes of a donor include proven fertility, completion of family, age 18-34 years and with no significant comorbidities.[8] There are relative contraindications to being an oocyte donor and these can include being a hepatitis B and C carrier, and HIV.

Carriers of singular gene disorders are generally discouraged from oocyte donation and extensive discussion with genetic counsellors and clinicians surrounding risk reduction would apply in cases involving such donors.[8] This also applies to donors aged over 35, where the risk of aneuploidy is much higher, and the chance of a live birth is lower for the intended recipient compared with a younger donor. Donation must be for altruistic purposes, it is illegal for a donor to be paid, and donors cannot be aged under 18 years.

Box 1. Indications for oocyte donation

- Ovarian dysfunction:
  - Premature ovarian insufficiency.
  - Low ovarian reserve.
  - Poor oocyte quality.
  - Gonadal dysgenesis.
- Medical conditions:
  - Inheritable disorders.
  - Medically induced ovarian failure, eg, chemotherapy.
  - Surgical removal of the ovaries.
- Repeated in vitro fertilisation failure.
- Same-sex couples.

What are the risks?

When considering oocyte donation, conduct a risk profile on the three ▸

◂ significant parties of concern: the donor, the recipient and the unborn child.

DONOR RISK

Risks to the donor are both physical and psychological. Risk of regret is significant and extensive counselling with a trained reproductive health counsellor is recommended, both before and after donation. Physical risks are related to the process of a stimulation cycle and can include, but are not limited to, infection, bleeding, pain, discomfort, ovarian hyperstimulation syndrome (see figure 4), abscess formation and ovarian torsion. There are also the associated anaesthetic risks and risks of anaphylaxis related to medication administration. The long-term risks of ovarian stimulation are still under research; however, there is some evidence to suggest increasing risks with increasing numbers of cycles including developing borderline ovarian tumours but not ovarian malignancy itself. As such, the American Society for Reproductive Medicine guidelines on oocyte donation advocate no more than six stimulated cycles.[9]

RECIPIENT RISK

The risks to the recipient are predominately around the physical risk of infection and the psychological risk of increased rates of anxiety, depression, and, on occasion, regret. Extensive counselling is also recommended for all recipients.

FETAL RISK

The risks to the intended child include that of transmissible infection, risks of genetic inheritance and psychosocial risks.

What is the process?

The process of ovarian stimulation for a donor is relatively straightforward. It typically starts on the first day of the menstrual cycle. The donor injects herself with a pre-determined dose of FSH to progressively grow multiple follicles on both ovaries. The FSH dose is determined based on maternal age, ovarian reserve and BMI. Premature ovulation is prevented using either a gonadotropin-releasing hormone (GnRH) agonist or antagonist. The follicular growth is monitored via transvaginal ultrasound and serial oestrogen, LH and progesterone assays are performed every few days.

Once the follicles have reached a peak size for collection the patient is given a 'trigger' medication to release the oocytes from the cumulus oocyte complex. Transvaginal oocyte collection is performed 36 hours later, whereby a small needle on the end of a transvaginal probe is used to collect the oocytes through the vaginal fornix. This procedure can be completed under general anaesthetic or with light sedation and local anaesthetic.

The oocytes are then combined with sperm in the laboratory and grown to an appropriate age (typically five days) before cryostorage. Both oocytes and embryos can be cryostored for an indefinite period.

If there is a surplus of either oocytes or embryos, these may be donated, utilised for medical research or disposed of once the patient has completed their treatment and no longer wishes to keep them cryostored.

The steps in oocyte donation are listed in box 2.

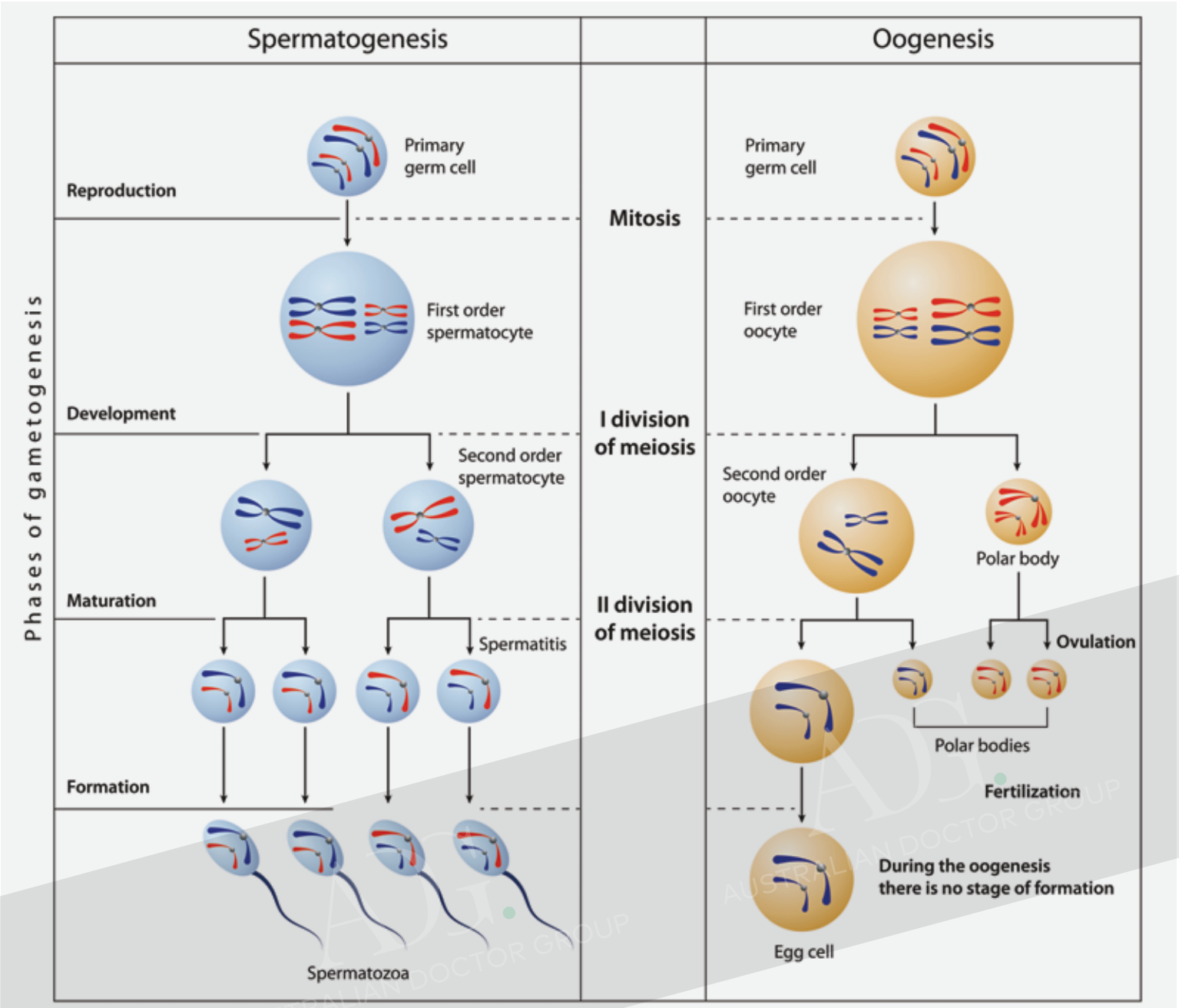


Figure 1. Gametogenesis.

Box 2. Process for oocyte donation

- Medical consultation and investigations to determine medical suitability (including genetic screening) for oocyte donation.
- Investigations to ensure there is no infective risk.
- Counselling about implications and signing of consents.
- Controlled ovarian hyperstimulation and oocyte collection.
- Creation of embryos using recipient partner's sperm and freezing of embryos for quarantine.
- Repeat of infection screening three months post-quarantine.
- Release of embryos from quarantine for recipient use.

Box 3. Common causes of azoospermia

- Pre-testicular causes:
  - — Primary GnRH deficiency:
    - Isolated congenital hypogonadotropic hypogonadism (Kallman syndrome).
    - Prader-Willi syndrome.
    - Other genetic disorders.
  - — Acquired GnRH deficiency.
    - Tumours, eg, hyperprolactinaemia.
    - Inflammatory disorders such as lymphocytic hypophysitis.
    - Trauma.
    - Iatrogenic.
- Testicular causes:
  - — Chromosomal:
    - Klinefelter syndrome (see figure 8).
    - Y-chromosome microdeletions.
    - Single gene mutations.
  - — Testicular maldescent.
  - — Varicocele.
  - — Infection.
  - — Iatrogenic, eg, use of drugs, medications, toxins or pesticide exposure.
- Post-testicular disorders:
  - — Congenital absence of the vas deferens.
  - — Epididymitis.
  - — Retrograde ejaculation.
  - — Erectile dysfunction.
  - — Vasectomy.

SPERM DONATION

AZOOSPERMIA (see figure 5) is defined as the absence of motile (viable) sperm (see figure 6) in the semen.[10] There are several causes of male infertility that may result in azoospermia, with the more common causes listed in box 3.[10,11]

There are many causes of azoospermia. Some of these are reversible. These include pathology of either the hypothalamus (such as Kallman syndrome) or the pituitary gland (such as iron infiltration) which can be treated with spermatic induction via the use of human chorionic gonadotropin +/- FSH. Some cases of azoospermia are obstructive, such as congenital absence of vas deferens with cystic fibrosis. In these patients, sperm is produced but cannot be transported out of the testes into the semen. This can be treated with needle aspiration of sperm from the testicle itself (see figure 7). Where these therapies are unsuccessful, sperm donation can be used. Finally, azoospermia may occur as a result of widespread testicular damage (such as in Klinefelter syndrome or post-chemotherapy). A small proportion of these patients still have pockets of spermatogenesis that can be found on open microscopic testicular dissection, but a significant proportion will require sperm donation. Sperm donation may also be utilised in contexts where infertility is not the presenting complaint. Such examples include same-sex couples and single patients wishing to start a family. Sperm donation is also an option if the male in a couple has a genetic disorder they wish to avoid passing onto their offspring and the couple do not want to undergo pre-implantation genetic diagnosis (whereby embryos are created using IVF, biopsied to test for the relevant genetic disorder, with only unaffected embryos selected for transfer and affected embryos discarded or used for research purposes).

Who can be a sperm donor?

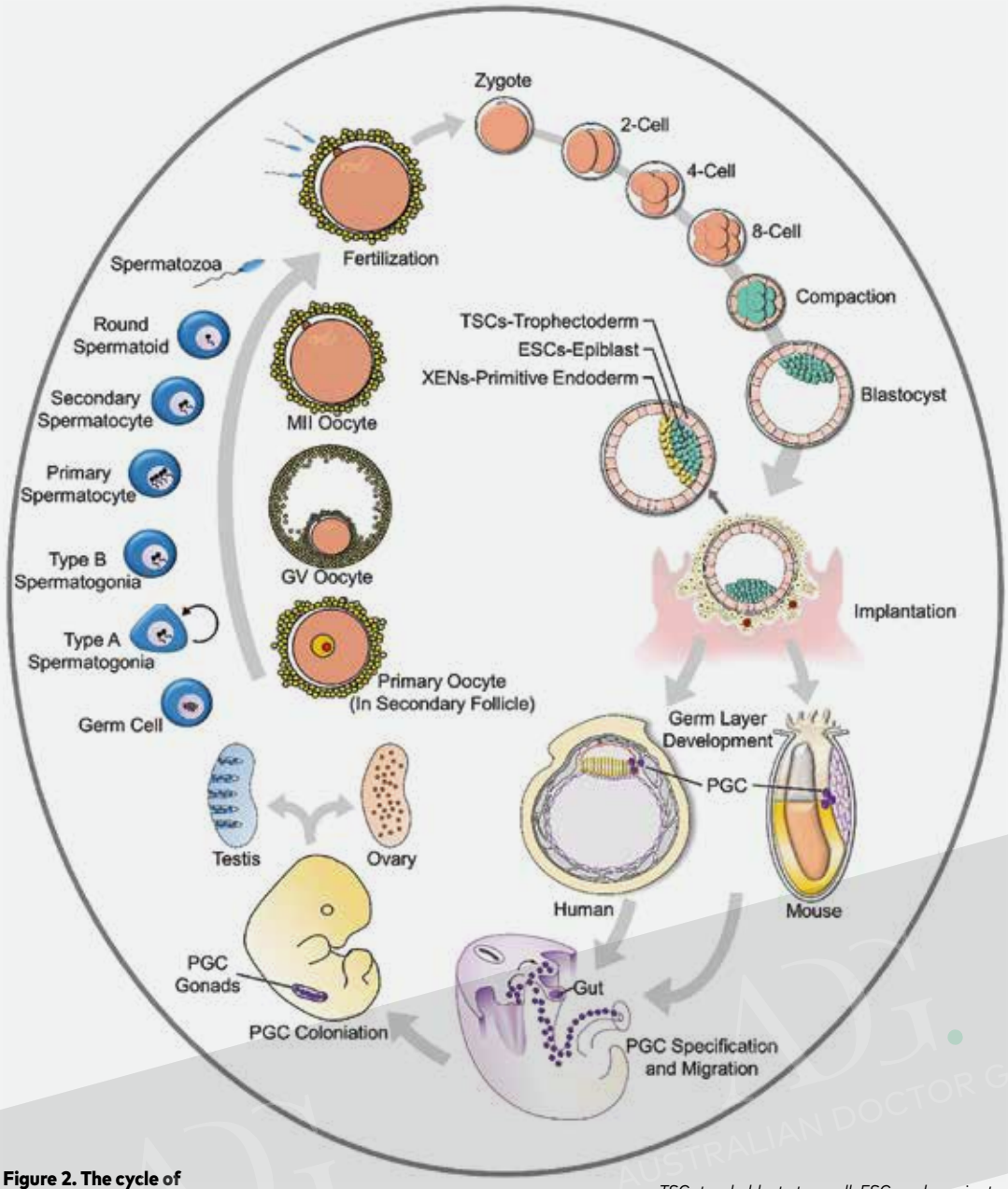
Like oocyte donation, sperm donation can either be from a known donor or a de-identified, screened, clinic recruited donor. The requirements for sperm donors are listed in box 4.[8] A normal semen analysis appears in table 1.[12]

What are the risks?

There are very few risks associated with sperm donation. Men who volunteer for sperm donation can self-collect. Associated risks may be identified during the screening process, for example identifying an underlying genetic or medical condition in the preliminary workup that was previously unknown to the donor. Additionally, psychological risks of associated regret or remorse remain, and the emphasis on the importance of counselling and informed consent is critical. The same risks apply for both the recipient and the intended child as with oocyte donation.

INVESTIGATIONS

ALL donors are required to undergo investigations to ensure there are no



Zhang P-Y, Fan Y, Tan T and Yu Y (2020) Generation of Artificial Gamete and Embryo From Stem Cells in Reproductive Medicine. Front. Bioeng. Biotechnol. 8:781. doi: 10.3389/fbioe.2020.00781/CC BY/bit.ly/3x46KEd

Figure 2. The cycle of gametogenesis and embryo development.

TSC=trophoblast stem cell; ESC=embryonic stem cell; XEN=extraembryonic endoderm; PGC=primordial germ cell; GV=germinal vesicle; MII=metaphase II.

Box 4. Requirements for sperm donors

- Aged 18-50 years.
- A normal sperm sample and willingness to produce several semen samples as needed.
- Able to provide a full medical history including biological origins, family and medical history and lifestyle implications.
- Undergo a sexual health screen, including syphilis, gonorrhoea, chlamydia, hepatitis B, hepatitis C, HIV, human T-cell lymphotropic virus type 1 and 2.
- Agree to being screened for cystic fibrosis and any genetic conditions relevant to their racial group.
- Undergo counselling about implications.

Table 1. Normal semen analysis

Parameter	Lower reference limit*
Total sperm number (106 per ejaculate)	39 (33-46)
Semen volume in mL	1.5 (1.4-17)
Sperm concentration (106 per mL)	15 (12-16)
Total motility (progressive and non-progressive) %	40 (38-42)
Progressive motility %	32 (31-34)
Vitality (live spermatozoa) %	58 (55-63)
Sperm morphology (normal forms) %	4 (3.0-4.0)

**(5th centiles and their 95% confidence intervals)* *Source: WHO[12]*

Box 5. Donor investigations

- Hepatitis B surface antigens.
- Hepatitis C antibodies.
- HIV serology.
- Human T-cell lymphotropic virus type 1 and 2.
- VDRL.
- CMV and avidity testing.
- Thalassaemia screening.
- AMH (oocyte donor only).
- Karyotype.
- Urine chlamydia (sperm donor only).

Box 6. Investigations for the intended recipient and gestational carrier

- FBC.
- Blood group and antibodies.
- Hepatitis B surface antigens.
- Hepatitis C antibodies.
- HIV serology.
- Thalassaemia screening.
- Karyotype (if utilising own oocyte).
- Pelvic ultrasound with an antral follicle count.
- Consideration of tubal assessment studies.

medical issues that will impede donation (see box 5).

All donor provided gametes (oocyte and sperm) must undergo a quarantine period (which is typically three months). At the conclusion of this period, the tests in box 5 are repeated (with the exception of karyotype, thalassaemia screening, and anti-Mullerian hormone [AMH]) to ensure the donor's infectious disease risk profile has not changed. This step is to reduce the risk of transfer of infectious diseases.

The investigations for the intended recipient and gestational carrier are listed in box 6.

It is important that both recipients and donors have a consultation to discuss the role of genetic carrier screening. It is now recommended that anyone seeking to achieve a pregnancy should consider genetic carrier screening, which assesses the risk of a child inheriting an autosomally recessive condition.[13] This is not yet mandatory in Australia but is strongly recommended. The most common conditions for which screening is performed include cystic fibrosis, spinal muscular atrophy and fragile X syndrome. However, extended carrier screening can be utilised to assess carrier status for hundreds of potentially hereditary conditions.

Success rates with egg and sperm donation

In the case of oocyte donation, the rate of success is related mainly to the age and health of the oocyte donor rather than the recipient. ▸

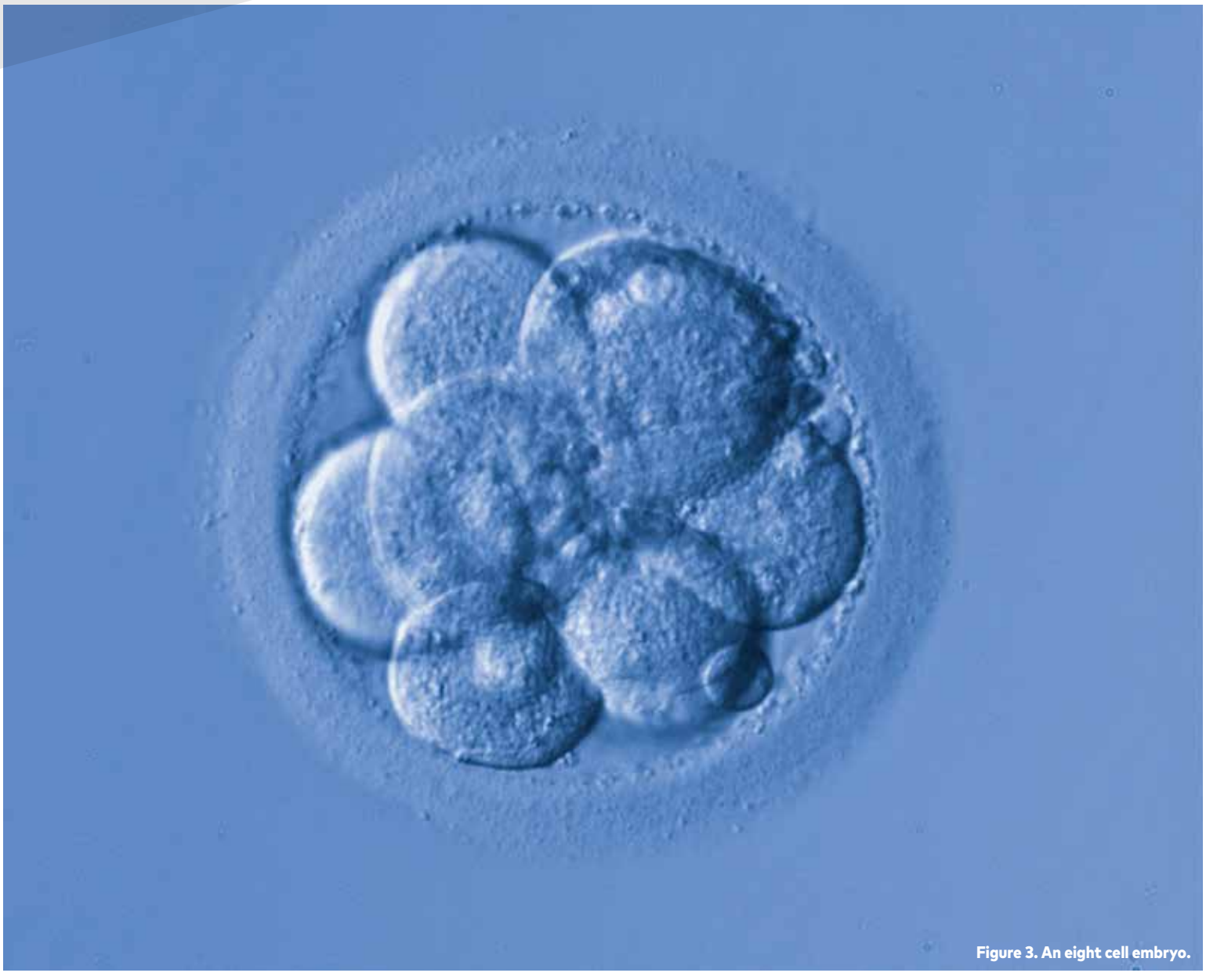


Figure 3. An eight cell embryo.

While the success rates of oocyte donation are not exactly the same as their age-matched autologous oocyte counterparts, they are very close.

Success rates with sperm donation relate to the quality of the sperm itself which can be affected by age but also by other factors such as the general health of the sperm donor. The quality of the oocytes of the intended recipient is also crucial to the success rate and this is, in turn, driven by factors such as age of the recipient as well as her general health.

Financial costs

It is expected that the commissioning woman/couple are responsible for the following costs:

- Donor consultation and investigation including genetic screening.
- Any costs related to storage of the gametes.
- IVF costs related to the donation.
- Any other medical costs incurred by the donor throughout the course of the donation.

LEGISLATION AND LEGAL IMPLICATIONS

THE Commonwealth of Australia has no governing legislation to regulate donor conception practices; these are regulated by the states and territories. NSW, Victoria, SA and WA have individual legislation. Any commercial trading in human gametes, or use of direct or indirect inducements, is prohibited by legislation on donor conception. If there is no governing legislation, the NHMRC guidelines on ethical use of reproductive technology in clinical practice should be adopted.[14] Where states have elected not to have governing legislation, the principles outlined in the Prohibition of Human Cloning for Reproduction Act (2002) and the Research Involving Human Embryos Act (2002) are applied.[15,16]

The key principles of donor conception that are common to all legislation, regardless of state, are the altruistic nature of intended donation; that donor conception can no longer be anonymous; and that there are family limit restrictions per donor.

Donation must be altruistic. Any commercial trading in human gametes, or use of direct or indirect inducements, is prohibited by legislation.[14] Legislation prohibits the payment of 'valuable consideration' for donated oocytes, sperm or embryos. However, it permits the payment of 'reasonable expenses' incurred by the donor in connection with supplying oocytes, sperm or embryos.[17] On a practical level, this means that the donor's medical expenses can be paid by the recipient, but no other financial incentive or gifts may change hands.

Donor anonymity is also universally addressed. In Australia, any person born as a result of donor gametes may, on reaching age 18, obtain identifying information about the gamete donor. This legislation was not always in place; several decades ago, donors were able to donate on the assumption that their details would never be released. However, access to and disclosure of donor information is still variable state by state.

In NSW, the central donor registry was established by 2010, following the Assisted Reproductive Technology Act in 2007.[18] The registry contains both mandatory and voluntary information regarding donors and applies to all conceptions from 1 January 2010.[19] Those born from conceptions before 2010 can apply for de-identified information regarding the donor. This information (if available) includes relevant medical history, ethnicity, sex and year of birth of any other offspring resulting from a donation. The identity of the donor, however, is not released without their express consent.

Any commercial trading in human gametes, or use of inducements, is prohibited by legislation.

In contrast, 2016 Victorian legislation enables all donor-conceived individuals to obtain identifying information about their donor, regardless of when they were conceived.[20] This legislation was considered progressive; it advocates for donor-conceived individuals knowing factors relevant to their identity, including medical history, genetic predisposition, risks of consanguineous relationships and psychological identity. The law was not without controversy regarding the retrospective allowing of access to information, as donor anonymity was previously guaranteed.[20] Retrospective access is now allowed if the information is available.

Despite the legislation surrounding anonymity of donors, some states, including SA and Queensland, do not have a central registry. These states rely on clinic specific registration of donors; individuals born from donor conception are required to contact the individual clinic if seeking information.

The other key component PAGE 38 ▶

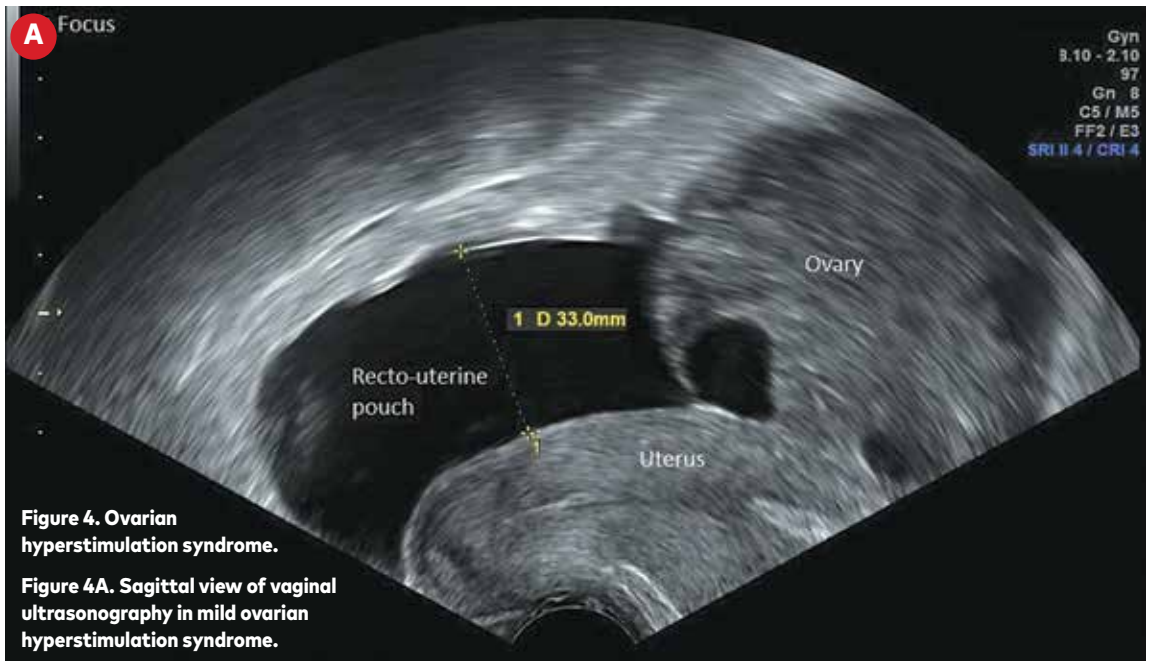


Figure 4. Ovarian hyperstimulation syndrome.

Figure 4A. Sagittal view of vaginal ultrasonography in mild ovarian hyperstimulation syndrome.

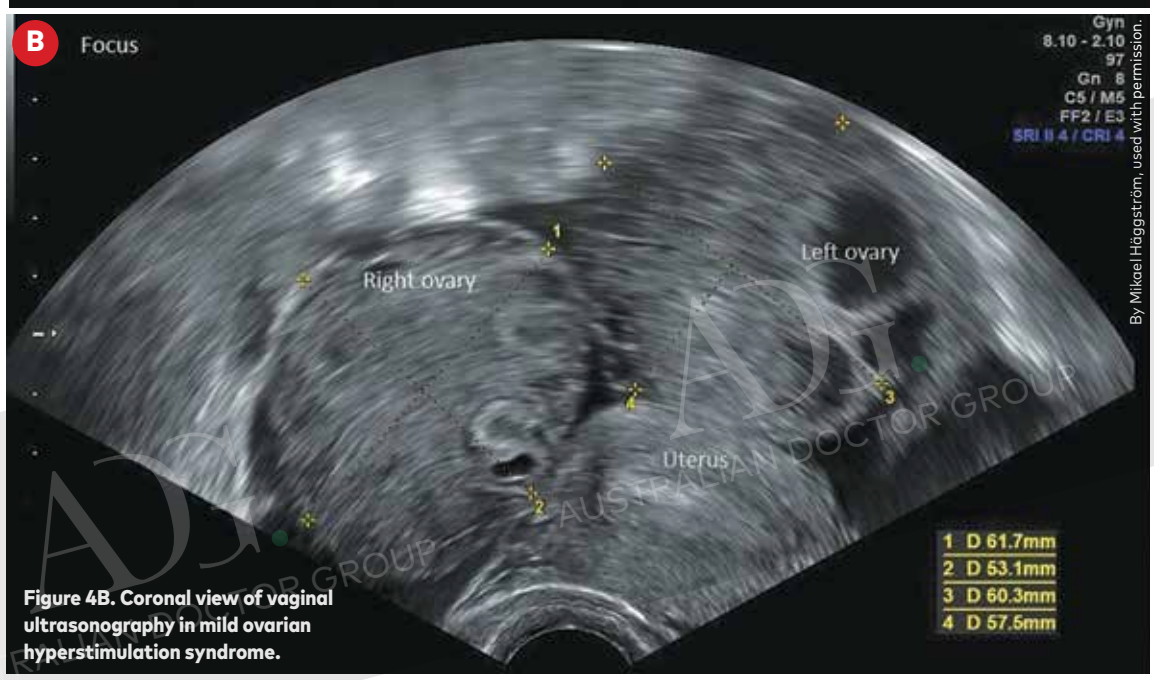


Figure 4B. Coronal view of vaginal ultrasonography in mild ovarian hyperstimulation syndrome.

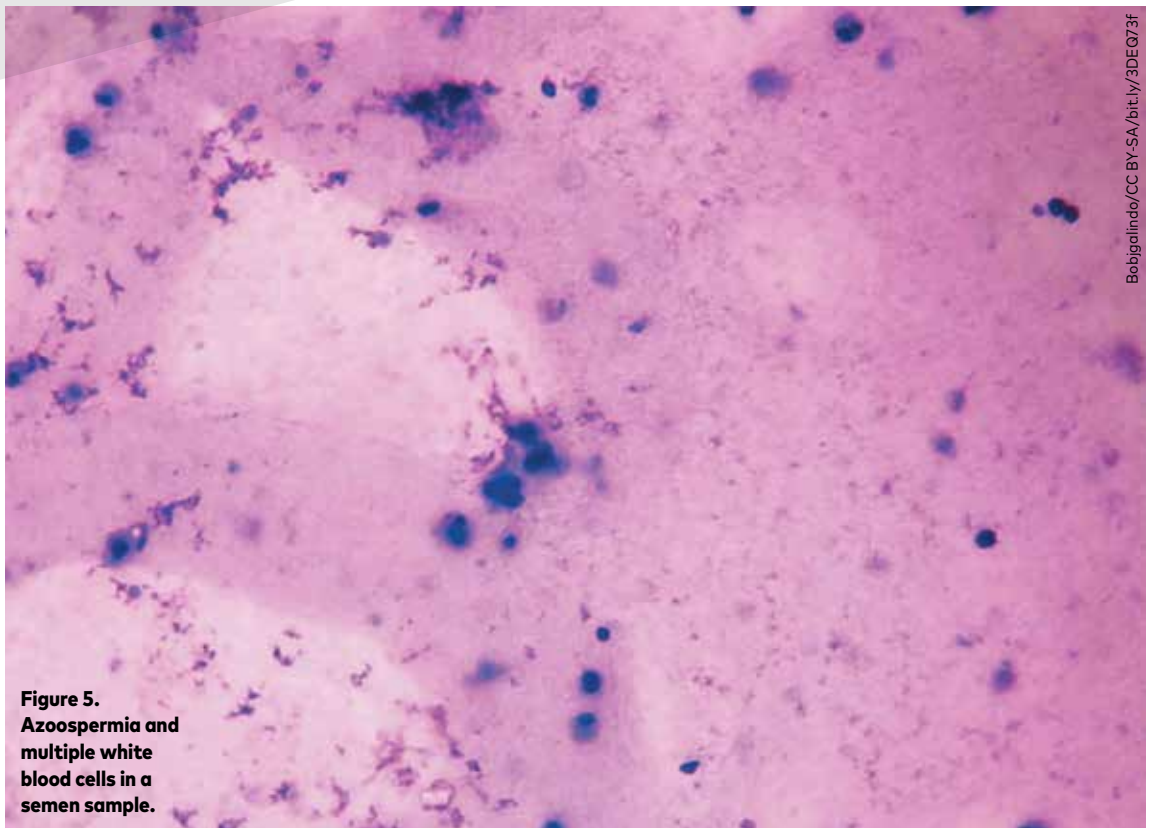


Figure 5. Azoospermia and multiple white blood cells in a semen sample.

◂PAGE 36 of legislation addresses family limits. Family limits in the context of donor conception is a set of guidelines regarding how many children or families can be reasonably created from a single donor.[21] These limits were set with several goals in mind. These include reducing the risk of relationships forming between people who are unknowingly genetically related, and thus reducing the risk of consanguinity. Another goal is to address the psychosocial implications of having multiple donor-conceived siblings across many families. State and territory legislation limits vary regarding the number of 'families', or in some cases 'women', who can receive a donation from a single donor (see table 2).[21]

DONOR ETHICS

THE ethics underlying donor assisted conception are complex and important and should be addressed with both the recipient and intended donor. The underlying principles of medical ethics including autonomy, beneficence, non-maleficence and justice should be applied; the NHMRC guidelines specifically seek to address the ethical parameters that clinicians should follow.[14]

These principles focus on the autonomy of both parties. It is vital that both parties have freedom of choice and autonomy in relation to their reproductive choices. The NHMRC advocates that clinicians promote and support the notion of informed consent as a fundamental condition of the use of ART for donor-assisted conception.[14] However, it is important to recognise that the individual's or couple's autonomy may be constrained by the ethical and legal parameters that govern practice. In the context of donor-assisted conception it is important to acknowledge that people's relationships, that is, blood relative vs long-term friendship will influence and shape the autonomy of each individual and the decision-making principles moving forward.

A large focus of donor ethics centres on the rights of the donor offspring, hence the movement away from anonymous donation. It has been recognised that donor offspring have the right to know their biological origins, and the principle of non-maleficence particularly applies in the setting of not causing harm or distress to parent, donors or the intended child.[14] The Australian Health Ethics Committee has identified the importance of balancing needs, concerns and interests of all relevant parties that may include the intended parent, gamete or embryo donor, a surrogate and any child or further children within the family unit.[14,19]

It is also significant to acknowledge that donation is altruistic. This deontological principle asserts that human beings have an inalienable right to dignity and are not to be viewed as a commodity or as saleable. From the point of distributive justice, the ability to pay a donor should not determine who has access to a donor.

DONOR AND RECIPIENT COUNSELLING

DECISION-making must be supported by the provision of access to counselling by a professional with the appropriate training, skills, experience and competency to counsel in reproduction. Counselling should be offered to gamete, gonadal tissue or cell donors, about the risks and the psychosocial and ethical implications of donation. Intended parent(s) must be provided with relevant information surrounding the process as well as counselling.

The counselling service must meet general requirements, and counsellors should be adequately trained (accredited by the Australian and New Zealand Infertility Counsellors Association. They should be equipped to provide an opportunity to discuss and explore issues, including the potential personal and social implications for the person who may be born and for the individual couple, provide support to the couple and facilitate access to networks as appropriate, such as referral to other specialist services.[14]

Counselling is a key component in ensuring valid consent and records are required to document that all relevant provision of information and counselling requirements have been satisfied by all parties before going ahead with assisted conception.

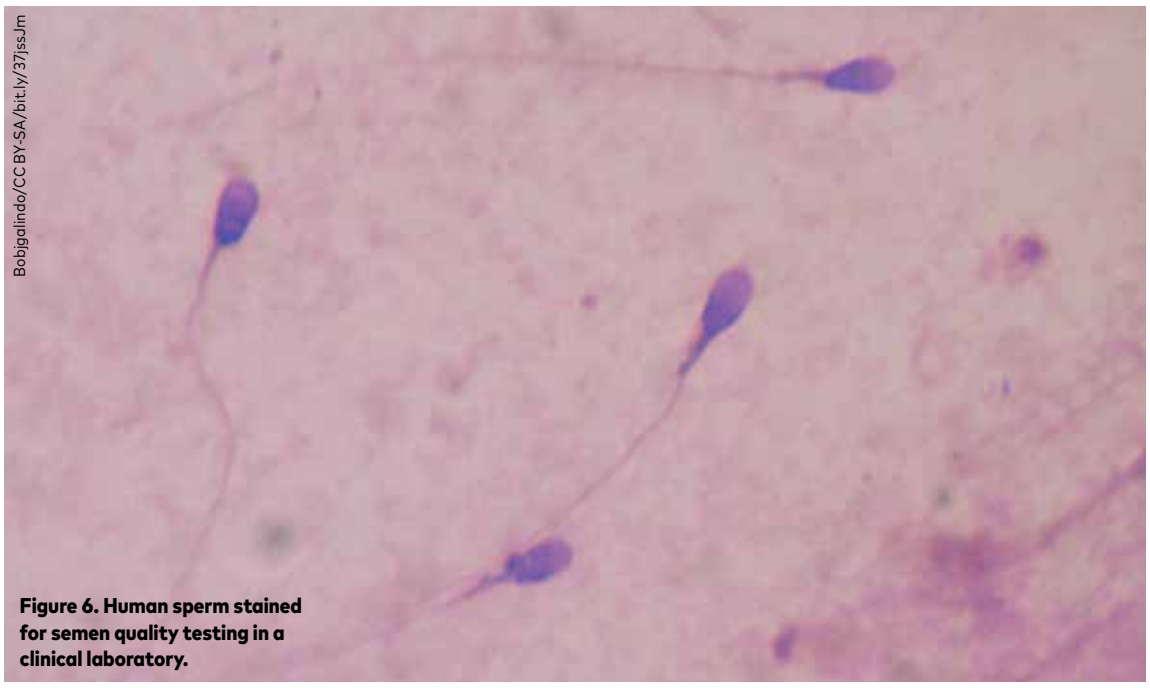


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Figure 6. Human sperm stained for semen quality testing in a clinical laboratory.

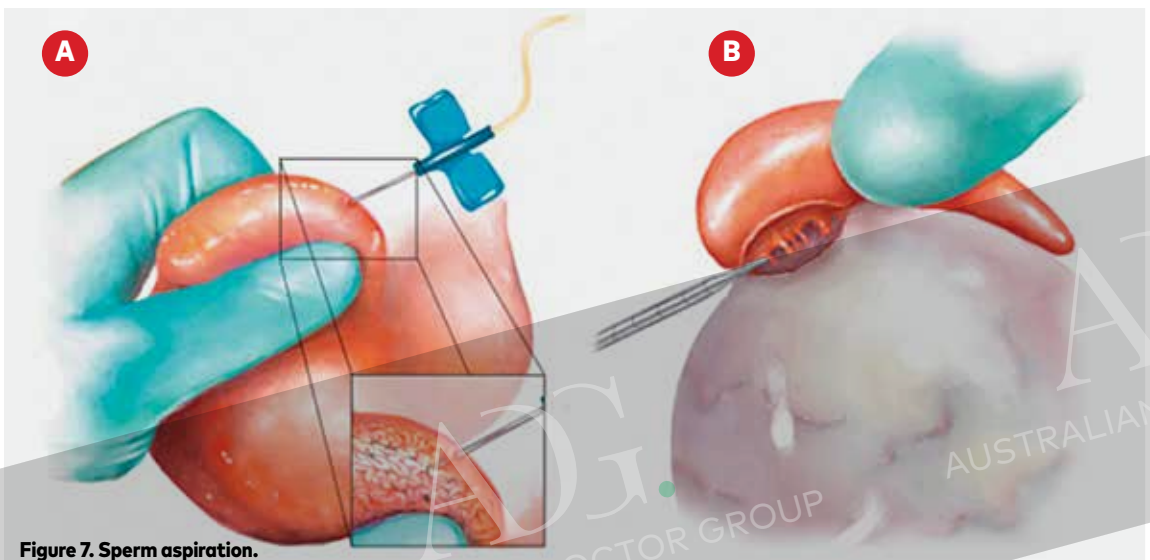

Figure 7. Sperm aspiration.

Figure 7A. Percutaneous epididymal sperm aspiration. Under local anaesthetic (skin and cord block), a 21–26-gauge needle is inserted into the epididymis, and epididymal fluid is aspirated for the presence of sperm.

Figure 7B. Microsurgical epididymal sperm aspiration. Under general anaesthetic, the testis is delivered and the tunica vaginalis is opened exposing the epididymis. The caput of the epididymis is reflected gently by incising the tunica albuginea at the junction of the testis and caput. The efferent ducts are visualised, and one is punctured. A micropipette is used to aspirate the sperm containing fluid by capillary action.

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Table 2. State and territory guidelines for recipients from one donor

	Laws	NHMRC guidelines/Reproductive Technology Accreditation Committee
NSW	5 women*	
Victoria	10 women	
WA	5 families	
SA		10 families**
ACT		10 families**
NT		10 families**
Tasmania		10 families**
Queensland		10 families**

**Subsection of the guidelines outline that the five women limit does not prevent the provision of ART using a donated gamete to a woman if:*
"- the woman or the spouse of the woman is the parent of a child born as a result of ART using a donated gamete from the same donor, or
- the woman belongs to a class of women prescribed by the regulations for the purposes of this section"
***This applies worldwide and is enforced where there is no specific act or guidelines governing a state or territory*

CASE STUDIES

Case study one

CHERYL, 37, is a teacher and her wife Sarah, 33, is a banker. They live in Sydney, NSW. They present to their GP to explore options for expanding their family.

Cheryl would like to be the gestational carrier and utilise her own oocytes for conception. Cheryl has never been pregnant and has a regular menstrual cycle with no significant symptoms of dysmenorrhoea or menorrhagia. She has an up-to-date cervical screening test and no history of STIs. Her past medical history is significant for a previous appendicectomy, but no other surgery and she is not on any regular medications. Cheryl is a non-smoker and does not drink any alcohol.

The GP discusses the family planning goals with Cheryl and Sarah: how many children they are aiming to have, and do they have an intended donor or are they seeking to utilise a sperm bank. Cheryl and Sarah have a donor in mind, a long-term college friend of Sarah's, Matthew. The GP discusses the importance of engaging in counselling and seeking individual legal advice for both parties, so they are fully informed before engaging in the process.

Cheryl will require investigations to ensure there are no compounding health implications for

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Malcolm Gin/CC BY-SA/bit.ly/3j7kmXe

Figure 8. Klinefelter syndrome.

pregnancy. Tests include FBC, blood group and antibodies; thalassaemia screening; serology for syphilis, hepatitis B and C and HIV, rubella and varicella immunity status; and AMH, hormone profile and thyroid function tests. A transvaginal pelvic ultrasound looking at antral follicle count is required as well as confirmation of tubal patency via hystero-salpingo contrast sonography. The GP orders Cheryl's investigations and provides written information on donor assisted conception for the couple.

The GP advises that Matthew should engage with his GP for a discussion about his health status and for referral for baseline investigations such as hepatitis B and C, and HIV serology and a sperm analysis.

The GP also discusses the benefits and recommendations about genetic carrier screening, identifying that both or either of the intended parties can engage in this process and that it is recommended to complete before achieving a pregnancy.

The GP refers the couple to a fertility specialist to engage in the processes involved with donor assisted conception. Cheryl and Sarah meet with the fertility specialist as does Matthew, in a separate consultation.

They are advised regarding the principles of donor-assisted conception including that the process is no longer anonymous, it is altruistic and there are family limits in place in NSW (see table 2*). This rule dictates that in NSW a donor can only create five families including their own and are therefore only allowed to donate to four women other than their own partner.

All investigations are normal, Cheryl and Sarah undergo counselling about the implications and provide valid and informed consent.

Figure 9.
Cryostorage.

As Cheryl currently has unproven fertility, her first-line treatment is intrauterine insemination (IUI). If IUI is unsuccessful after 3-4 cycles, IVF would be recommended.

Matthew provides a semen analysis with the recommended investigations and has adhered to a quarantine period and investigations.

As Cheryl has a regular menstrual cycle and was ovulating, IUI is performed. A positive pregnancy test is confirmed, and an intrauterine pregnancy is demonstrated four weeks later on ultrasound.

Case study two

Emma, 30, and David, 42, consult their GP regarding difficulty falling pregnant. They have been trying to conceive for more than a year.

Emma has an irregular menstrual cycle (reporting only 1-2 periods per year). She has a significant past medical history of non-Hodgkin's lymphoma, diagnosed at age 24, when she underwent chemotherapy. She was not offered any fertility preservation at the time and was informed that she may not be able to have children. David's past medical history is unremarkable.

Emma wants to know if she can fall pregnant by herself or will need an egg donor. A routine physical examination is unremarkable. The GP orders hormonal investigations, an AMH and ultrasound.

The hormone profile reveals an oestrogen level less than 18pmol/L, FSH elevated at 39 IU/L, LH elevated at 20 IU/L and AMH is less than 5% predicted for age at 0.2pmol/L. Note that reference ranges will differ based on the laboratory and the timing in the cycle. The pelvic ultrasound demonstrates a normal appearance of the uterus, tubes and ovaries with no antral follicles present on either ovary. The GP suspects Emma has premature ovarian insufficiency secondary to chemotherapy and refers the couple onto a fertility specialist for consultation around family planning.

Emma and David are reviewed by a fertility specialist and are accepting of the diagnosis of premature ovarian insufficiency. Emma recalls being told at the time of her chemotherapy that this was a possibility. The importance of hormone replacement for cardiovascular protection and bone health is also discussed at this consultation.

Regarding fertility, Emma and David have been talking to Emma's cousin Josephine who is 34, has had two spontaneous pregnancies and feels that she has completed her family. She has never been a donor to any other women. All intended parties undergo counselling about the implications and seek legal advice. Josephine has no medical concerns and undergoes an IVF cycle (controlled ovarian hyperstimulation with FSH and oocyte collection) where eight oocytes are collected. These are fertilised, and four embryos develop into day-five blastocysts and are cryostored (see figure 9).

Following the three-month quarantine period for donated embryos, Emma undergoes a programmed cycle to induce menstruation and a single cryostored embryo is transferred. She is not successful with both her first and second embryo transfers. However, a positive pregnancy test is confirmed in her third embryo transfer and a live intrauterine pregnancy confirmed on ultrasound four weeks later. Emma and David have one remaining embryo that they intend to utilise in the future.

ROLE OF THE GP

GPs require an understanding of the broad principles of oocyte and sperm donation, including the indications, so they are able to explain the process of egg and sperm donation to their patients, and to make appropriate referrals to a fertility specialist with expertise in this area.

CONCLUSION

DONOR conception is an important component of ART and there are many births in Australia from either oocyte or sperm donation. It is important that both clinicians and patients embarking on donor assisted conception are aware of the associated risks, legislation and implications of these decisions.

FURTHER READING

- **The Fertility Society of Australia and New Zealand Donor Program**
  bit.ly/2V8q42x
- **NHMRC — Ethical guidelines on the use of assisted reproductive technology in clinical practice and research**
  bit.ly/3jCjaMA

References
Available on request from howtotreat@adg.com.au

How to Treat Quiz.

EGG AND SPERM DONATION

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1. **Which THREE statements regarding human oocyte and embryo donation are correct?**
   - **a** The average age of a woman undertaking an oocyte or embryo recipient cycle is 40.3.
   - **b** The average age of a woman undertaking use of donor insemination is 34.5 years.
   - **c** Almost all women undergoing ART will utilise donor oocytes.
   - **d** Oocyte donation is more common than embryo donation.

2. **Which THREE are indications for an oocyte donation?**
   - **a** Age over 55.
   - **b** Gonadal dysgenesis.
   - **c** Poor oocyte quality.
   - **d** Premature ovarian insufficiency.

3. **Which TWO are desirable medical attributes of an oocyte donor?**
   - **a** Proven fertility.
   - **b** Unwilling to accept payment.
   - **c** No significant comorbidities.
   - **d** Related to the recipient.

4. **Which THREE are risks associated with oocyte donation?**
   - **a** Regret in both donor and recipient.
   - **b** Ovarian hyperstimulation syndrome in the recipient.
   - **c** Infection in the recipient.
   - **d** Genetic inheritance in the fetus.

5. **Which THREE are requirements for oocyte donation?**
   - **a** Laparoscopy.
   - **b** Controlled ovarian hyperstimulation using FSH.
   - **c** Oocyte collection.
   - **d** Screening for infection prior to commencing treatment.

6. **Which ONE is not a post-testicular cause of azoospermia?**
   - **a** Congenital absence of the vas deferens.
   - **b** Premature ejaculation.
   - **c** Epididymitis.
   - **d** Erectile dysfunction.

7. **Which THREE are requirements for sperm donors?**
   - **a** A normal sperm sample and willing to produce several semen samples.
   - **b** Undergo a sexual health screen.
   - **c** Agree to being screened for relevant genetic conditions.
   - **d** Having O positive blood group.

8. **Which TWO investigation requirements are mandatory in donors and recipients?**
   - **a** Hepatitis B and C screening in donors and recipients.
   - **b** Genetic carrier screening in donors.
   - **c** HIV serology in donors and recipients.
   - **d** Six-week quarantine period for all donor provided gametes.

9. **Which THREE key principles of donor conception are common to all legislation?**
   - **a** A donor cannot change his/her/their mind about donation once consent forms are signed.
   - **b** The altruistic nature of intended donation.
   - **c** Donor conception can no longer be anonymous.
   - **d** There are family limit restrictions per donor.

10. **Which THREE statements regarding gamete donation are correct?**
    - **a** The principles of medical ethics including autonomy, beneficence, non-maleficence and justice apply.
    - **b** Consent as a fundamental condition of the use of ART for donor assisted conception.
    - **c** Counselling of all parties by an appropriately trained professional is vital.
    - **d** A donor is free to provide as many donations as they desire, so long as they are altruistic.

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