REVIEW

Transcervical Ultrasound-Guided Intrafallopian Placement of Gametes, Zygotes, and Embryos

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BACKGROUND

Since the pioneering work of Patrick Steptoe and Robert Edwards resulted in the first birth following human in vitro fertilization (IVF), there has been great interest in improving existing methods and developing new techniques for assisted reproduction. In 1984, Ricardo Asch and his colleagues described the first human pregnancy after placement of male and female gametes into the fallopian tube (gamete intrafallopian transfer or GIFT) (1). This procedure involved the aspiration of ovarian follicles by laparoscopy or minilaparotomy and the replacement of oocytes with spermatozoa into one or both normal fallopian tubes. The claimed advantage of this technique over IVF is that placing the gametes into normal oviducts may mimic more closely the natural conditions for fertilization, embryo cleavage, and tubal transport of the embryo into the uterine cavity. It is hoped that, in selected patients, the use of the in vivo physiologic oviductal milieu may improve implantation and term pregnancy rates. The related techniques of PROST (pronuclear-stage transfer) (2), ZIFT (zygote intrafallopian transfer) (3), and TET (tubal embryo transfer) have a similar rationale.

A requirement for the intratubal placement of gametes (or zygotes and embryos) is the presence of at least one functionally normal oviduct. Therefore, the absence of a healthy tube(s) necessitates the use of IVF. Patent tubes and healthy tubes are not, of course, necessarily synonymous. Since the patient populations where one technique or another can be applied are different, and the conditions and timing within a therapeutic plan when these techniques are introduced vary considerably, caution is warranted in the comparison of success rates. For example, some centers do IVF or GIFT only after a minimum number of cycles of failed ovarian stimulation with or without intrauterine insemination; other centers may recommend GIFT at the time of initial diagnostic laparoscopy. One prospectively randomized, controlled study did not demonstrate any statistically significant difference in success rates between IVF and GIFT when used in couples with unexplained infertility or mild male-factor infertility (4). Nevertheless, despite the paucity of rigorously obtained data, there is a continued interest in GIFT as a technique for improvement of pregnancy rates per transfer in some subgroups of infertile couples.

One obvious disadvantage of performing GIFT exclusively is that diagnostic information, desirable in couples with male-factor or unexplained infertility, on the presence or absence of fertilization is not obtained unless conception occurs. Even when GIFT is performed concomitantly with IVF, in vitro assessment of sperm-egg interaction may be compromised by the selection of the morphologically best-appearing oocytes for intratubal placement. For this reason, there is increasing interest in transferring the fertilized oocyte [zygote intrafallopian transfer (ZIFT) (3) or pronuclear-stage transfer (PROST)] (2) or two- to eight-cell embryos (tubal embryo transfer or TET) into the oviduct. The latter techniques allow documentation of sperm-egg interaction in vitro and also take advantage of the in vivo oviductal environment.

A major disadvantage of conventional GIFT, ZIFT, and TET is that they must be performed using laparoscopy or minilaparotomy under general or
regional anesthesia, while IVF can be performed entirely nonsurgically in an outpatient setting under local anesthesia (5). Since the first reports of the use of ultrasound for oocyte retrieval in IVF (6-8), ultrasound guidance for follicular aspiration has gained great popularity and widespread application. The advent of ultrasound-guided techniques, especially since the introduction of the transvaginal ultrasound probe in 1986, has made retrieval quite simple and possible even for patients with laparoscopically inaccessible ovaries.

RECENT DEVELOPMENTS

In 1985, Platia and Krudy reported an intrauterine pregnancy following transvaginal fluoroscopic recanalization of a proximally occluded oviduct (9). The feasibility of transvaginal/transcervical cannulation of the proximal fallopian either with fluoroscopic guidance or with the use of the hysteroscope was subsequently confirmed by several investigators (10-13). These techniques attempt to restore proximal tubal patency; in those patients where this is successful, laparotomy for cornual reanastomosis, with its more extensive costs and risk, can be avoided. Success with these techniques naturally led to the idea that the fallopian tube could be cannulated from its proximal end for the performance of various assisted reproduction techniques.

ULTRASOUND-GUIDED TECHNIQUES

With the intention of making intrafallopian placement procedures totally ultrasound-guided, R. P. S. Jansen and J. C. Anderson of Sidney IVF in Australia devised a transcervically placed catheterization system and described their success with its use for the placement of spermatozoa into the normal fallopian tubes of women who had failed standard artificial inseminations (14). This technique was demonstrated in an award-winning film shown at the Fifth World Congress of in Vitro Fertilization and Alternate Assisted Reproduction in 1987 (15). This catheter system is made by William A. Cook Australia Pty., Melbourne, and consists of two cannulas. The outer cannula is a flexible, opaque 5.5 French Teflon catheter 28 cm in length with a curved tip. It is introduced transcervically with its metal obturator; the malleable obturator can be bent to allow passage through the cervical canal. Once the outer cannula is placed into the uterine cavity, removal of the metal obturator allows the Teflon catheter to assume the lateral curve in its “memory” and its tip to approximate the uterotubal junction on the right or left side. The presence of the tip of the outer cannula at the cornu is confirmed by the use of transvaginal ultrasound with a 5- or 7-MHz phased-array transducer. Once the outer cannula is in place, an inner catheter is advanced through it into the proximal portion of the fallopian tube. The inner catheter is 33 cm long, made of soft Teflon, and its 3 French diameter tapers to 2 French in its distal 3-5 cm. Correct placement of the inner cannula can be tested by injection of small amounts of 5% CO₂ in air or agitated sterile culture medium (containing bubbles), which can be seen on ultrasound traveling laterally into the adnexal area.

If placement is deemed satisfactory, a duplicate inner catheter loaded with a small volume (preferably 10-20 μl) of transfer medium containing the gametes (sperm only or sperm and oocytes), zygotes, or embryos is placed into the fallopian tube and its contents are gently injected in the vicinity of the isthmic–ampullary junction. Drs. Jansen and Anderson describe that both the patient and the operator have “characteristic sensations of passage” when the inner catheter is introduced through the uterotubal junction. This has also been experienced by the authors, especially the operator’s sensation. We deem this “feel” to be important, as a limitation of the current Cook catheter system is its generally poor visibility with ultrasound. As both the Australian group and our group perform these tubal cannulation procedures with only mild sedation and/or analgesia, the patient can verbalize the mild unilateral discomfort often experienced with inner catheter passage into the proximal tube.

RESULTS

The Australian group has utilized this ultrasound-guided tubal cannulation system and technique for the transfer of sperm only (intratubal insemination) (14), for the transfer of both gametes (USGIFT), and for the transfer of zygotes (USZIFT) and of cleaving embryos (USTET) (16,17). In 29 patients, tubal cannulation was successful in 46 of 50 cycles of attempted insemination; 6 intrauterine pregnancy-