

Uterus retrieval in cadaver: technical aspects

M. Erman Akar¹, O. Ozkan², M. Ozekinci¹, M. Sindel³, F. Yildirim³, N. Oguz³

¹Department of Obstetrics and Gynecology, Akdeniz University, Antalya; ² Department of Plastic Surgery, Akdeniz University, Antalya

³ Department of Anatomy, Akdeniz University, Antalya (Turkey)

Summary

The authors describe uterus retrieval in cadavers. Uterine retrieval with its vasculature could be successfully achieved in four of the presented cases. Special attention was given to dissection of bilateral ureters and hypogastric vasculature. Uterine retrieval with its vasculature and supporting sacrouterine, vesicouterine peritoneal folds is an anatomically feasible procedure in preparation for uterus transplantation.

Key words: Uterus retrieval; Uterus transplantation; Cadaver.

Introduction

Although inspiring developments have taken place in assisted reproductive technologies in the last decades, no current approach has been able to treat the problem known as uterine related infertility (URI) resulting from congenital or followed by hysterectomy [1-7]. The only accepted solution to URI to date has been gestational surrogacy which is not acceptable in all parts of the world.

The idea that uterine allotransplantation could be used in URI was supported by several animal studies resulting in healthy offspring [8-11]. The first uterine transplant attempt was performed in a Saudi Arabic woman in 2000 from a live donor [12]. The transplanted uterus had to be removed 99 days later possibly due to the weakness in surgical technique and obstruction of the anastomosed vessels. A good retrieval technique with adequate length of vasculature and width of supporting structures seems to be noteworthy for a successful attempt.

Materials and Methods

The authors report their initial experience in the retrieval of the human uterus from fresh frozen cadavers.

Following, institutional ethics committee approval, four fresh-frozen female cadavers were included in the study. The cadavers were obtained from Anatomy Department of Akdeniz University School of Medicine. All dissections were performed by two gynecologists, one plastic surgeon, and two anatomists. The cadavers were placed in the supine position, and a vertical midline incision was made from pubis to xiphoid process of sternum.

Uterine retrieval consisted of three main phases. First phase: dissection and transection of the bilateral round ligaments were completed to mobilize the bladder anteriorly. Mobilization of the upper vagina was achieved posteriorly by conserving the uterosacral ligaments and opening the peritoneal sheath. Second phase: ureters were dissected bilaterally starting from their course over common iliac bifurcation to their passage under the

uterine vessels. Third phase: bilateral internal iliac vasculature and uterine vessels were dissected.

Exploration time ranged from 95 to 150 (mean 110) minutes. Initially, the authors aimed to obtain an adequate exposure in the pelvis.

In the first phase of retrieval, they grasped and divided the round ligaments laterally to directly get access to parametrium by blunt dissection. The anterior leaves of the broad ligaments were incised and dissected anteriorly until vesicouterine reflection. Upper vagina was mobilized posteriorly by detaching uterosacral ligaments from the sacrum with overlying peritoneum.

In the second phase, the peritoneum was sharply opened lateral to the infundibulopelvic ligaments. With traction of the infundibulopelvic ligaments, the posterior leaves of the peritoneum were sharply opened and ureters were dissected bilaterally starting from their course over common iliac bifurcation and posterior to ovarian vessels to their passage under the uterine vessels to allow careful preservation of the uterine vessels. The authors tried to dissect and remove the bilateral cardinal ligaments (lateral areolar connective tissue bundles) as wide as possible for the purpose of lateral support during uterus transplantation.

In the third phase, psoas major muscle and external iliac vessels were identified by dissection. After grasping the posterior parietal peritoneum overlying the psoas major muscle (lateral to the external iliac artery) the peritoneum parallel to the external iliac artery was cut. Starting from the bifurcation, internal iliac vessels lying lateral and parallel to bilateral ureters were dissected as entirely as possible distal to the point of origin of its posterior division to maintain the branches to uterus intact and obtain the greatest length of the internal iliac vessels (Figure 1). Right side was easier to isolate than left due to the location of the sigmoid colon.

Finally the uterus, ten cm hypogastric artery, eight cm hypogastric vein, and three cm proximal vagina could be retracted in four cadavers with its vasculature and supporting ligaments (Figure 2). The uterus could not be completely retrieved in one cadaver due to its large size and solid fixed texture (possible uterine tumor).

Discussion

Uterine related infertility due to congenital or acquired agenesis of uterus has no treatment with current assisted reproductive technologies [1-6]. Through advances in sur-

Revised manuscript accepted for publication August 1, 2013

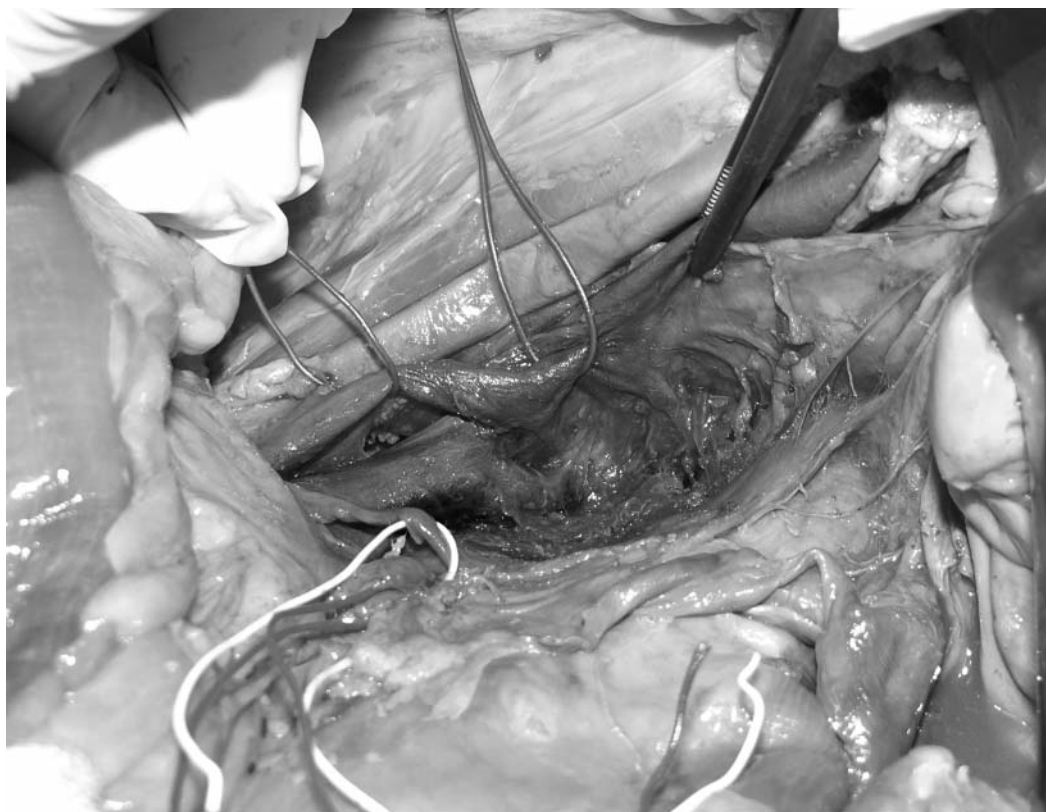


Figure 1. — Anatomic dissection of left ureter, external and internal iliac arteries, and vein in cadaver. EIA: External iliac artery, EIV: External iliac vein; ha: hypogastric artery; hV: hypogastric vein; u:ureter.

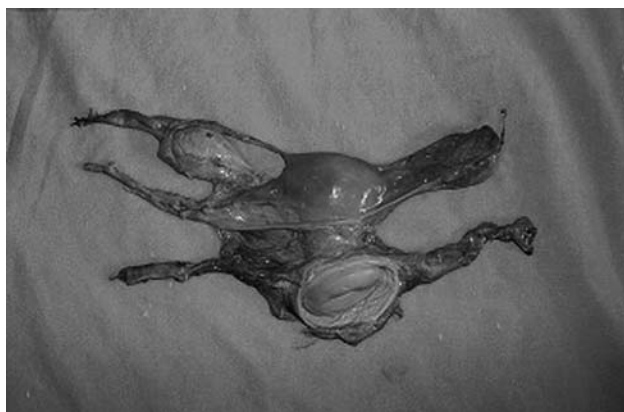


Figure 2. — Photograph of uterus with its vasculature and peritoneum following retrieval.

gical techniques, improvements in immunosuppressive agents and experience acquired from solid organ transplantations, and unusual allograft transplantations have gained acceptance especially in the last decades [8-20].

Unlike other organ transplantations, uterine transplantation is not a life-sustaining procedure with potential risks to live donor, recipient mother, and child [21]. Therefore previous experience in gynecologic oncology might be a major advantage in understanding the anatomy

and relationships of the retroperitoneal vasculature which is vital in avoiding serious injury.

It is important to preserve vascular supply of the ureter during dissection in a live donor not to cause fistula formation resulting from related thrombosis.

Dissection of internal iliac vessels with its major branches lying in the obturator fossa may be risky and difficult in a live donor related to the numerous and anomalous veins that occupy the lateral floor of the obturator fossa. Pelvic vasculature should be preserved as wide as possible in a live donor not to interfere with other organ function. It may be wise to ligate the hypogastric artery distal to the point of origin of its posterior division.

There are several discussions on the definition of cardinal ligaments (CL) [22]. Fritsch *et al.* have defined CL as the bundle connecting the pelvic brim and the uterine cervix [23]. American version of Gray's anatomy defined CL as extension of the perivascular sheath of the internal iliac vessels [24]. Dissection of the cardinal ligaments is quite difficult due to its areolar texture and proximity of the uterus vasculature and ureter.

Although this study is limited in showing the safety of the procedure, it confirms the anatomical feasibility of the uterus retrieval procedure with adequate vascular length and width of supporting ligaments. Cadaver dissection might be quite helpful in establishing a good retrieval technique.

References

- [1] Steptoe P.C., Edwards R.G.: "Birth after the reimplantation of a human embryo". *Lancet*, 1978, 2, 366.
- [2] Palermo G., Joris H., Devroey P., Van Steirteghem A.C.: "Pregnancies after intracytoplasmic injection of single spermatozoon". *Lancet*, 1992, 340, 17.
- [3] The Practice Committees of the American Society for Reproductive Medicine and the Society for Assisted Reproductive Technology: "Mature oocyte cryopreservation: a guideline". *Fertil. Steril.*, 2013, 99, 37. Available at: <http://download.journals.elsevierhealth.com/pdfs/journals/0015-0282/PIIS0015028212022479.pdf>
- [4] Donnez J., Silber S., Andersen C.Y., Demeestere I., Piver P., Meirow D., et al.: "Children born after autotransplantation of cryopreserved ovarian tissue: a review of 13 live births". *Ann. Med.*, 2011, 43, 437. doi: 10.3109/07853890.2010.546807
- [5] AbdelHafez F.F., Desai N., Abou-Setta A.M., Falcone T., Goldfarb J.: "Slow freezing, vitrification and ultra-rapid freezing of human embryos: a systematic review and meta-analysis". *Reprod. Biomed. Online*, 2010, 20, 209.
- [6] Brannstrom M., Diaz-Garcia C., Hanafy A., Olausson M., Tzakis A.: "Uterus transplantation: animal research and human possibilities". *Fertil. Steril.*, 2012, 97, 1269.
- [7] Beski S., Gorgy A., Venkat G., Craft I.L., Edmonds K.: "Gestational surrogacy: a feasible option for patients with Rokitansky syndrome". *Hum. Reprod.*, 2000, 15, 2326.
- [8] Racho El-Akouri R., Kurlberg G., Brannstrom M.: "Successful uterine transplantation in the mouse pregnancy and postnatal development of offspring". *Hum. Reprod.*, 2003, 18, 2018.
- [9] Ramirez E.R., Ramirez Nasseti D.K., Nasseti M.B., Khatamee M., Wolfson M.R., Shaffer T.H., et al.: "Pregnancy and outcome of uterine allotransplantation and assisted reproduction in sheep". *J. Minim. Invasive Gynecol.*, 2011, 18, 238.
- [10] Wranning C.A., Akhi S.N., Diaz-Garcia C., Brannstrom M.: "Pregnancy after syngenic uterus transplantation and spontaneous mating in the rat". *Hum. Reprod.*, 2011, 26, 553.
- [11] Diaz-Garcia C., Akhi S.N., Wallin A., Pellicer A., Brannstrom M.: "First report on fertility after allogenic uterus transplantation". *Acta Obstet. Gynecol. Scand.*, 2010, 89, 1491.
- [12] Fageeh W., Raffa H., Jabbad H., Marzouki A.: "Transplantation of the human uterus". *Int. J. Gynecol. Obstet.*, 2002, 76, 245.
- [13] Bedaiwy M.A., Shahin A.Y., Falcone T.: "Reproductive organ transplantation: advances and controversies". *Fertil. Steril.*, 2008, 90, 2031.
- [14] Del Priore G., Stega J., Sieunarine K., Ungar L., Smith J.R.: "Human uterus retrieval from a multi-organ donor". *Obstet. Gynecol.*, 2007, 109, 101.
- [15] Zhordonia I., Gotsiridze O.: "Vital activity of the excised uterus and its appendages after their autotransplantation into omentum". *Acta Chir. Plast.*, 1964, 6, 23.
- [16] Yonemoto R.H., Du Sold W.D., Deliman R.M.: "Homotransplantation of uterus and ovaries in dogs. A preliminary report". *Am. J. Obstet. Gynecol.*, 1969, 104, 1143.
- [17] Mattingly R.F., Clark D.O., Lutsky I.I.: "Ovarian function in uteroovarian homotransplantations". *Am. J. Obstet. Gynecol.*, 1970, 108, 773.
- [18] Montgomery R.A., Warren D.S., Segev D.L., Zachary A.A.: "HLA incompatible renal transplantation". *Curr. Opin. Organ Transplant.*, 2012, 17, 386.
- [19] Montgomery R.A., Lonze B.E., King K.E., Kraus E.S., Kucirka L.M., Locke J.E., et al.: "Desensitization in HLA incompatible kidney recipients and survival". *N. Engl. J. Med.*, 2011, 28, 318.
- [20] Lan X., Zhang M.M., Pu C.L., Guo C.B., Kang Q., Li Y.C., et al.: "Impact of human leukocyte antigen mismatching on outcomes of liver transplantation: a meta-analysis". *World J. Gastroenterol.*, 2010, 16, 3457.
- [21] Milliez J.: "Uterine transplantation FIGO Committee for the Ethical Aspects of Human Reproduction and Women's Health". *Int. J. Gynaecol. Obstet.*, 2009, 106, 270.
- [22] Ramanah R., Berger M.B., Parratte B.M., DeLancey J.O.: "Anatomy and histology of apical support: a literature review concerning cardinal and uterosacral ligaments". *Int. Urogynecol. J.*, 2012, 23, 1483.
- [23] Fritsch H., Hotzinger H.: "Tomographical anatomy of the pelvis, visceral pelvic connective tissue and its compartments". *Clin. Anat.*, 1995, 8, 17-24.
- [24] Clemente C.D.: "Gray's anatomy". 30th ed. Philadelphia: Lea and Febiger, 1985, 1575.

Address reprint requests to:
M. ERMAN AKAR, M.D.
Akdeniz University Hospital,
Department of Obstetrics and Gynecology,
H Blok 1. Kat PK:07070 Antalya (Turkey)
e-mail: meakar@akdeniz.edu.tr