Journal of Minimally Invasive Gynecology (2006) 13, 296–301

THE JOURNAL OF
MINIMALLY INVASIVE
GYNECOLOGY

Gestational sac aspiration: A novel alternative to Dilation and Evacuation for management of early pregnancy failure

Mohamed F. Mitwally, MD, Hafsa Albuarki, MBBS, Michael P. Diamond, MD, Mostafa Abuzeid, MD, and Michael M. Fakih, MD

From the Division of Reproductive Endocrinology and Infertility, Department of Obstetrics and Gynecology, Wayne State University, Detroit, (Drs. Mitwally and Diamond), IVF-Michigan, Rochester Hills, (Mr. Albuarki and Drs. Aubzeid and Fakih), and the Division of Reproductive Endocrinology and Infertility, Department of Obstetrics and Gynecology, Michigan State University, East Lansing, Michigan (Dr. Aubzeid).

KEYWORDS:
Dilation and evacuation;
Early pregnancy loss;
Gestational sac aspiration;
Miscarriage;
In vitro fertilization

Abstract

STUDY OBJECTIVE: To explore the effectiveness (success, safety, and complications) of a novel technique of gestational sac aspiration in the management of early pregnancy failure as an alternative to dilation and evacuation (D&E) and conservative management.

DESIGN: Prospective historical cohort study comparing effectiveness of gestational sac aspiration (study group) to conservative management (control group) with follow-up until negative quantitative beta human chorionic gonadotropin testing is achieved (Canadian Task Force classification II-1).

SETTING: An infertility treatment center.

PATIENTS: Among 60 women with failed early pregnancies that were achieved by in vitro fertilization or intrauterine insemination, 20 underwent gestational sac aspiration, whereas 40 chose conservative management.

INTERVENTIONS: Gestational sac aspiration was done by transvaginal ultrasound–guided needle aspiration under conscious sedation. Aspirated tissue was sent for karyotyping. Both study and control (conservative management) groups received close follow-up with ultrasound and serial beta human chorionic gonadotropin measurements.

MEASUREMENTS AND MAIN RESULTS: There was no significant difference in age, infertility factor, or treatment between study and control groups. Mean gestational age was 8 versus 6 weeks in study and control groups, respectively ($p < .05$). One and 11 patients required D&E in the study and control groups, respectively ($p < .05$). Karyotyping was successful in all except one patient in the study group. Chromosomal abnormalities were found in 36% of products of conception. No significant complications occurred

CONCLUSION: Gestational sac aspiration is a simple and safe outpatient technique that is more effective than conservative management of early pregnancy failure and less invasive than D&E. Moreover, the technique provides a high probability of obtaining a noncontaminated adequate gestation tissue sample for chromosomal study.

Corresponding author: Mohamed Mitwally, MD, 7372 Deep Run Drive, TH 10, Bloomfield Hills, MI 48301.
E-mail: mmitwally@yahoo.com
Submitted January 2, 2006. Accepted for publication March 8, 2006.

1553-4650/$ -see front matter © 2006 AAGL. All rights reserved.
doi:10.1016/j.jmig.2006.03.005

Early pregnancy failure is a common event and complicates up to 15% of clinically recognized pregnancies.[1,2] This could occur even more frequently in pregnancies after infertility treatment, including assisted reproduction. Each year, an average of 35 per 1000 women of childbearing age have an abortion, making abortion one of the most common health events in women's lives.[3,4]

For the management of early pregnancy failure, there are several therapeutic options including surgical evacuation of the products of conception, expectant management, and medical management. For more than 50 years, surgical treatment such as dilation and evacuation (D&E) has historically been the best route to achieve a rapid resolution of the problem because of its effectiveness in complete evacuation of the products of conception. However, surgical intervention, despite overall effectiveness and safety, is not without possible serious complications (e.g., uterine perforation), a small risk of complications related to anesthesia, and surgical complications such as intrauterine adhesions, cervical trauma, and infection in addition to the inevitable high cost.[5]

Several alternatives to surgical management have been introduced into the clinical practice of managing early pregnancy failure, including expectant and medical management aimed at the self expulsion of the products of conception and complete resolution without the need for further surgical interventions. Expectant conservative management is probably the most feasible option in general practice for most cases of miscarriage.[6] Medical management, which usually implies the systemic or local administration of a prostaglandin analog, is considered a promising alternative because it is expected to decrease hospitalization cost and overcome the risk of surgical complications. The effectiveness of different treatment modalities has been assessed by several randomized, controlled trials that reported significant differences in terms of complete evacuation and complication rates, between alternative interventions in different patient population groups.[5] The objective of this study was to explore the effectiveness (success, safety, complications, and outcome) of a novel technique of gestational sac aspiration in the management of early pregnancy failure as an alternative to D&E.

Materials and methods

This is a prospective historical cohort study conducted after obtaining approval by the local institutional review board of Wayne State University. The study was conducted at an infertility treatment center (IVF-Michigan) from January 2002 through January 2005. The study included 60 infertile women with failure of early pregnancy that was achieved after infertility treatment. In 14 women, pregnancies were achieved after ovarian stimulation with intrauterine insemination, whereas 46 women achieved pregnancy after in vitro fertilization embryo transfer (IVF-ET). Early pregnancy failure was diagnosed by failure to detect fetal pole or fetal cardiac activity, or cessation of previously detected fetal cardiac activity on transvaginal ultrasonography in conjunction with failure of serum beta human chorionic gonadotropin (β-hCG) levels to rise appropriately. Gestational age at which pregnancy failure was diagnosed ranged from 5.4 through 11.1 weeks. All patients were in a stable clinical condition without significant complications, such as vaginal bleeding or uterine cramps.

Patients were thoroughly counseled regarding the different management modalities, including the standard routine of D&E, expectant conservative management (with detailed revision of warning symptoms and signs of potential complications including bleeding and infection), as well as the option of aspirating the products of conception (gestational sac aspiration) under transvaginal-ultrasound guidance. Twenty patients accepted the option of gestational sac aspiration, whereas the remaining 40 patients opted for expectant conservative management with close outpatient follow-up with repeat serial measurements of serum β-hCG levels.

After consent was obtained for the procedure, gestational sac aspiration was done with the patient under conscious sedation as an outpatient procedure by the treating reproductive endocrinologist. Through a transvaginal approach, an oocyte-aspiration needle (16-gauge, with a tip that can be visualized ultrasonographically) was used with negative pressure (180 to 200 mL water) generated by an oocyte-retrieval suction machine to aspirate the gestational sac(s). The negative suction was applied until full collapse of the targeted sac occurred. The whole procedure was done under transvaginal-ultrasound guidance. The needle was inserted through the needle guide that was attached to the transvaginal-ultrasound probe. The needle was advanced, under direct vision, through the vaginal mucosa into the wall of uterus to the central point of the gestational sac. The path of the needle was identified through the needle guide line, which is a line seen through the transvaginal ultrasound view illustrating the pathway of the needle. It is important to mention here that the needle should to be advanced through the shortest pathway between the vaginal ultrasound probe and the center of the gestational sac (thinnest part of the uterine and vaginal walls). Obviously, the cervix should be avoided because passing the needle through the cervix would require traveling through a much longer pathway. Ultrasound visualization helps to avoid injury of important structures such as blood vessels. While applying negative suction, the gestational sac could be seen emptying under the negative suction. Patients were discharged home after reasonable observation for uterine contractions or vaginal bleeding. Patients in both the study and control groups stopped receiving progesterone supplementation that was given previously as per routine in pregnancies after intrauterine insemination or IVF-ET.

There were no significant complications such as bleeding, infections, or anesthetic complications during or immediately after the procedure before discharging patients

Table 1 Patients' characteristics (age, gestational age, and levels of β hCG) on the day of diagnosing pregnancy failure, and making decision as regards pursuing an expectant management (control group) or active management by gestational sac aspiration (study group)

	Control group (Expectant conservative management)	p	Study group (gestational sac aspiration)
Number of patients	40	NA	20
Percentage of pregnancies following IVF-ET	75%	.8	80%
*Age (years)	39 (24–48)	.98	39 (22–44)
Parity	0 (0–3)	.75	0 (0–3)
*Gestational age (weeks)	6.5 (4–8)	.01	6 (5.4–11.1)
*β hCG (IU/ml)	8232 (2848–22 572)	.76	9233 (1126–29 749)

$p < .05$ considered statistically significant.
*Data presented as median (range).

home. One dose of antibiotics was given during the procedure. The aspirated products of conception were sent for chromosomal analysis in all except in five patients who declined the chromosomal analysis.

For patients who opted to try the option of expectant conservative management, follow-up by office visits including repeat β-hCG was done with adequate counseling regarding the risks and benefits of the expectant management. Follow-up visits were done on a nearly weekly basis. Criteria for discontinuation of expectant management and undergoing surgical evacuation of the products of conception included development of significant vaginal bleeding, evidence of infection, failure of progressive decline of β-hCG levels, or when requested by the patient. Expectant conservative follow-up was carried out until β-hCG levels were below 5 IU/mL. Patients who underwent gestational sac aspiration were followed up similarly to those who received expectant conservative management. Patients were subsequently followed until pregnancy was achieved in the course of their infertility treatment, or until a period of 6 months follow-up had passed after gestational sac aspiration.

The patients' characteristics were compared between the study group (gestational sac aspiration group) and the control group (expectant conservative management group). Outcomes including complications, duration of follow-up, and decline in serum levels of β-hCG have also been compared between the two groups. The control group has been further subdivided into a subgroup of successful expectant conservative management (no dilation and evacuation was required) that included 29 patients, and the subgroup that included the remaining 11 patients (failed expectant conservative management). Outcome measures were also compared between the two control subgroups.

Statistical analysis

The following statistical tests were used where appropriate to analyze various data (patients' characteristics, as well as treatment outcomes [complications and follow-up parameters]) between the patient groups: Student's t test and χ^2 test (continuous and dichotomous variables respectively) considering p value $< .05$ statistically significant. The statistical tests were performed with Sigma Stat for Windows Version 1.0 software (Sigma Stat Software High Edit Professional; Micro Help Inc and Heiler Software GmbH, San Rafael, CA).

Results

Table 1 shows patients' characteristics (age, gestational age, and levels of β-hCG) on the day of diagnosing pregnancy failure and making the decision with regard to pursuing an expectant management (control group) or active management by gestational sac aspiration (study group). Except for gestational age that was significantly lower in the control group, there was no statistically significant difference between the study and control groups.

The same set of characteristics in Table 1 is presented in Table 2 comparing the successful expectant conservative management subgroup and unsuccessful subgroup (required D&E). There was no statistically significant difference between the two groups except for the serum level of β-hCG that was significantly higher in the unsuccessful subgroup. Unlike the comparison between the study and control groups, gestational age was not significantly different between the two subgroups, although a tendency for higher gestational age was noticed in the unsuccessful subgroup.

Table 3 compares the various complications (vaginal bleeding, pain, fever, and retained products) between the expectant management (control group) and active management by gestational sac aspiration (study group). Retained products were defined as ultrasonographic detection echogenic intrauterine contents with a diameter more than 10 mm. As mentioned earlier, no major complications were encountered in either of the two groups. However, failure rate (D&E required) was statistically significantly higher in the control group (expectant conservative management), which reported significantly more cramps (without requir-

Table 2 Patients' characteristics (age, gestational age, and levels of β hCG) on the day of diagnosing pregnancy failure in the control group who failed expectant conservative management and the successful expectant conservative management

	Successful expectant conservative management	p	Failed expectant conservative management (D&E subgroup)
Number of patients	29	NA	11
Percentage of pregnancies following IVF-ET	83%	.78	73%
*Age (years)	39 (22–44)	.29	38 (23–44)
*Gestational age (weeks)	6.9 (4.5–7.1)	.19	6.8 (5.1–8.3)
*β hCG (IU/ml)	9844 (222–19 749)	.05	1226 (10 121–22 755)

$p < .05$ considered statistically significant.
*Data presented as Median (range).

ing analgesics). All adverse effects were reported within the first 3 weeks of follow-up.

In the gestational sac aspiration group, three patients had retained products, two were passed spontaneously, whereas the third required D&E for serum β-hCG levels that failed to decrease during the follow-up period (the one failure case in the study group). In the control group, retained products were seen on ultrasound scanning in 4 patients who did all pass them spontaneously without complications.

Figure 1 shows the mean gestational age on the day of making decision with regard to pursuing expectant conservative or active management (gestational sac aspiration) in the study and two subgroups of the control group. Gestational age was significantly higher compared with the other two groups ($p < .05$) but not between the two subgroups when compared against each other.

Figure 2 shows the mean levels of β-hCG on the day of making a decision with regard to pursuing an expectant conservative management (failed and successful expectant management control subgroups) or active management (gestational sac aspiration group). Mean of serum β-hCG level was significantly higher in the failed expectant management subgroup compared with the successful expectant management subgroup, but not when compared with the study group (gestational sac aspiration). On the other hand, the mean of rate of decline of serum β-hCG levels (β-hCG levels per day) was significantly lower in the failed expectant management subgroup when compared with the other subgroup (successful expectant management subgroup) or the study group (gestational sac aspiration) as shown in Figure 1.

Table 3 Compares the various complications (vaginal bleeding, pain, fever and retained productions) between the expectant management (control group) or active management by gestational sac aspiration (study group)

	Control group (Expectant conservative management)	Study group (gestational sac aspiration)
Number of patients	40	20
Failure (required D&E)	11 (27.5%)*	1 (5%)*
Vaginal bleeding (spotting)	19 (48%)	9 (45%)
Vaginal bleeding (similar to menstrual bleeding, did not require emergency intervention)	11 (28%)	5 (25%)
Cramps required no analgesics	21 (53%)*	2 (10%)*
Uterine cramps relieved by analgesics	4 (10%)	3 (15%)
Fever	0	1 (5%)
Retained products of conception	4 (10%)	3 (15%)

Data are presented as number (percentage).
*Statistically significant ($p < .05$).

Figure 3 compares the mean number of days until a negative serum level of beta hCG (<5 IU/mL) between the study (gestational sac aspiration group) and successful expectant management subgroup. In the successful expectant management subgroup, it took a longer period (statistically significantly, $p < .05$) for serum β-hCG levels to go down to <5 IU/mL.

In the gestational sac aspiration group, patients were offered chromosomal evaluation of the products of conception by karyotyping. Five patients declined; whereas in the other 15, chromosomal analysis was successful in 14 patients but failed in one. However, it is important to mention here that in seven patients (four in the study group and three in the control group) the karyotyping was 46-XX. This could still be a maternal contamination. The rate of chromosomal abnormalities was 36% (triploidy in one patient, trisomy 21 in two patients, trisomy 22 in one patient, and one patient had monosomy of X chromosome (turner syndrome). The remaining nine patients had normal chromosomal karyotyping (five 46-XY and four 46-XX). In the failed expectant management group, only three patients had chromosomal karyotyping; all were normal with 46-XX chromosomes.

All patients have been followed for a minimum period of 6 months after negative serum β-hCG levels. Eight, 4, and 11 patients achieved uneventful pregnancies in the gestational sac aspiration group, failed expectant management subgroup, and successful expectant management subgroup, respectively. There was no evidence of uterine cavity disorders in any the patients either in the control or study

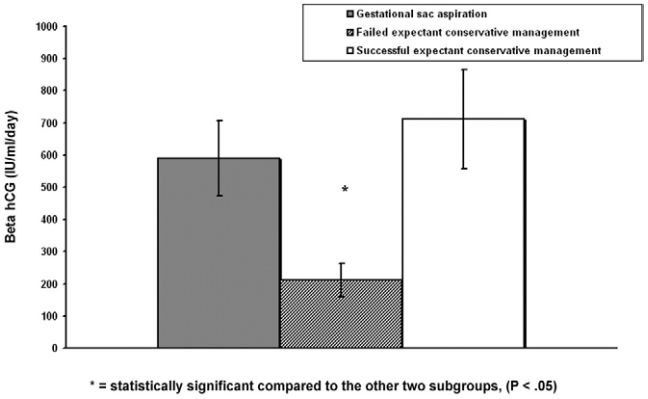

Figure 1 Mean decline in β-hCG levels per day after day of making decision with regard to pursuing expectant conservative management (failed and successful expectant management control subgroups) or active management (gestational sac aspiration group).

groups. This was confirmed by sonohysterography in all patients.

Discussion

This study presents data suggesting the success and safety of a novel technique for surgical evacuation of the products of conception from the uterine cavity in a group of patients who had early pregnancy failure during the first trimester. Of 20 patients who underwent gestational sac aspiration for the management of early pregnancy loss, only one patient required D&E for retained products associated with serum β-hCG levels that did not decrease along the follow-up period. On the other hand, in the expectant conservative management group, 11 patients required D&E making a failure rate of 27.5% that was significantly higher than the failure rate (5%) in the gestational sac aspiration study group. However, we should be careful and not overestimate such a high success rate in the study group for two reasons; the small size in the study and the non-randomization nature of the study. In addition, expectant conservative management was successful in almost two-thirds of the

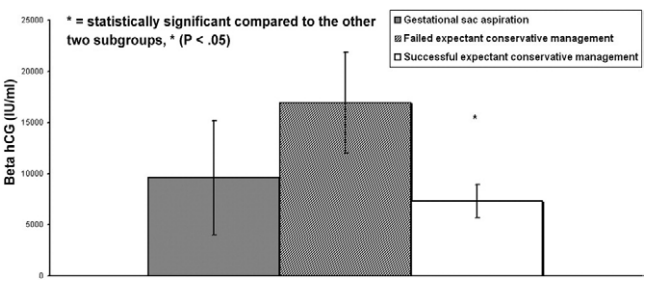

Figure 2 Mean levels of β-hCG on day of making decision with regard to pursuing expectant conservative management (failed and successful expectant management control subgroups) or active management (gestational sac aspiration group).

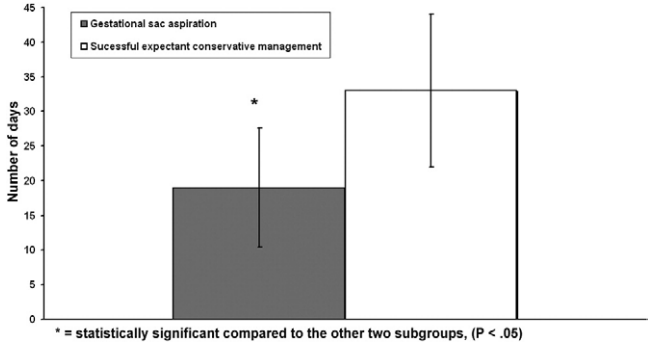

Figure 3 Mean number of days until negative β-hCG level was achieved.

patients (72.5%) who would have, anyhow, made it in the study group without intervention if they had received no intervention.

As presented in Figures 2 and 4, patients with advanced gestational age associated with higher levels of serum levels of β-hCG were more likely to fail expectant management and needed D&E. In addition, the rate of decline in serum levels of β-hCG per day was an important factor in predicting failure of expectant management. However, the number of patients was not large enough to draw strong conclusions or allow conducting the pertinent statistical tests looking at the value of declining β-hCG levels in predicting outcome of expectant management.

To our knowledge, there is only a single case report in the literature that looked at the use of fine needle aspiration of the gestational sac as an alternative for D&E in one patient who had severe cervical stenosis that could not be negotiated safely by cervical dilators.[7] However, the technique of gestational sac aspiration is not a new one. It has been reported for several years, with increasing popularity in the recent years particularly in the field of assisted reproduction. Transvaginal sonographically guided needle aspiration of selective gestational sacs has been widely used for therapeutic multifetal reduction of

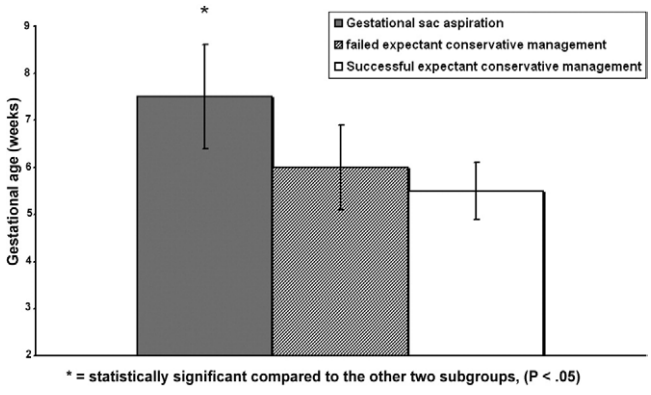

Figure 4 Mean gestational age on day of making decision with regard to pursuing expectant conservative management (failed and successful expectant management control subgroups) or active management (gestational sac aspiration study group).

high-order multiple pregnancies to lower-order twins or singleton pregnancies.[8] Moreover, the technique has been reported before in critical situations such as ectopic pregnancies in which an abnormally situated gestational sac could be successfully aspirated[9] either alone when a concurrent healthy intrauterine pregnancy existed, (heterotopic pregnancy) or with the injection of methotrexate when surgical excision was dangerous, such as with cervical pregnancy and cornual-esthmic tubal pregnancy.[10] We are not aware of any publications regarding the safety and efficacy of such an approach for cases of early pregnancy failure. Presenting the data in this small study would encourage further investigation of the feasibility of this technique for further applications such as therapeutic elective termination of pregnancy. One significant theoretical advantage of the technique of gestational sac aspiration is obtaining a fetal tissue sample that would be free of maternal tissue contamination, a problem that would be more frequently encountered with other approaches of fetal tissue sampling such as D&E. However, our study does not provide adequate data regarding this potential.

Conclusion

In summary, gestational sac aspiration is a simple procedure that can be done under ultrasonographic guidance through a transvaginal approach for management of early pregnancy failure. The procedure seems to be effective and without major complications. It can be done under conscious sedation in an office setting. It might carry the advantage of less maternal tissue contamination when seeking genetic study on the products of conception. Despite the vast experience with the technique of gestational sac aspiration in the area of reproductive genetics (for therapeutic multifetal reduction), the technique has not been yet expanded to include potential applications in managing early pregnancy failure.[11]

References

1. Wilcox AJ, Weinberg CR, O'Connor JF, et al. Incidence of early loss of pregnancy. *N Engl J Med*. 1988;319:189–194.
2. Regan L, Braude PB, Trembath PL. Influence of past reproductive performance on risk of spontaneous abortion. *BMJ*. 1989;299:541–545.
3. Bongaarts J, Porter RG. *Fertility, Biology and Behavior: An Analysis of Proximate Determinants*. New York: Academic Press; 1983.
4. Alan Guttmacher Institute. Sharing responsibility: women, society and abortion worldwide. New York: AGI; 1999.
5. Sotiriadis A, Makrydimas G, Papatheodorou S, Ioannidis GPA. Expectant, medical, or surgical management of first-trimester miscarriage: a meta-analysis. *Obstet Gynecol*. 2005;105:1104–1113.
6. Ankum WM, Wieringa-De Waard M, Bindels PJE. Management of spontaneous miscarriage in the first trimester: an example of putting informed shared decision making into practice. *BMJ*. 2001;322:1343–1346.
7. Chen HJ, Hsieh BC, Hwang JL. Fine needle aspiration of the gestational sac for termination of early pregnancy in cervical stenosis: a case report. *J Reprod Med*. 2004;49:133–135.
8. Ralston SJ, Craigo SD. Ultrasound-guided procedures for prenatal diagnosis and therapy. *Obstet Gynecol Clin North Am*. 2004;31:101–123.
9. Maymon R, Halperin R, Mendlovic S, Schneider D, Vaknin Z, Herman A, Pansky M. Ectopic pregnancies in Caesarean section scars: the 8 year experience of one medical centre. *Hum Reprod*. 2004;19:278–284.
10. Cepni I, Ocal P, Erkan S, Erzik B. Conservative treatment of cervical ectopic pregnancy with transvaginal ultrasound-guided aspiration and single-dose methotrexate. *Fertil Steril*. 2004;81:1130–1132.
11. Oyawoye S, Chander B, Pavlovic B, Hunter J, Gadir AA. Heterotopic pregnancy: successful management with aspiration of cornual/interstitial gestational sac and instillation of small dose of methotrexate. *Fetal Diagn Ther*. 2003;18:1–4.