Cardiac Tamponade: An Alternative Procedure for Late Feticide

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SUMMARY

Objective: Improvements in equipment and diagnostic skills mean that more abnormalities can now be detected antenatally, thus increasing the demand for pregnancy termination at later stages of gestation. Potassium chloride injected into the fetal circulation is the most frequently used procedure. In this study, we propose a new method of feticide using injection of normal saline into the fetal pericardial space to induce cardiac tamponade, resulting in late fetal reduction with minimal maternal risk.

Case Report: A 32-year-old, gravida 6, woman was a carrier of a balanced translocation 45,XX,der(2),t(2,22), and had a poor obstetric history. Chorionic villus sampling was performed, and the results revealed the fetus to be a balanced translocation carrier, like the mother. Microcephaly was detected during the third trimester and amniocentesis was performed. The results showed a 45,XX,der(2)t(2;22)(q37,q11.2)mat,–22 karyotype. After counseling, the mother elected to undergo pregnancy termination. Feticide was performed before labor induction. However, she experienced discomfort when a minimal amount of potassium chloride (3 mEq) was injected into the fetal heart, without inducing fetal asystole. We, therefore, induced cardiac tamponade using 10 mL of normal saline instilled into the fetal pericardial space. Fetal asystole was noted. The whole procedure was performed without incident, and termination was achieved by hysterotomy after informed consent was given.

Conclusion: Many methods of feticide have been used, including injection of potassium chloride, lidocaine, digoxin or hyperosmolar urea into the fetal circulation. However, these methods all use medications or compounds with some potential for maternal toxicity or side effects. We provide a relatively safe and effective method of feticide for use in late termination of pregnancy. [*Taiwan J Obstet Gynecol* 2009;48(2):159–162]

Key Words: aneuploidy, cardiac tamponade, feticide, late termination

Introduction

Feticide was first used for reduction of multifetal pregnancies in the 1980s, to improve pregnancy outcome and reduce the risk of prematurity. Studies by Evans et al [1] and Dumez and Oury [2] described a surgical approach to improve the outcome in such cases. Under certain circumstances such as fetal abnormalities, this procedure could be used for the termination of singleton pregnancies, as initiated during the early to mid-1990s in the United Kingdom. Late termination of pregnancy (LTOP) is defined as termination at a time when gestation approaches viability. The minimum gestational age for fetal viability is usually considered to be between 22 and 24 weeks. To prevent fetal distress, feticide is necessary prior to LTOP. A 1996 Royal College of Obstetricians and Gynaecologists document suggested that feticide could be performed for gestations later than 22 weeks, but this was later reinterpreted in 2001: "For all terminations at gestational age of more

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than 21 weeks and 6 days, the method chosen should ensure that the fetus is born dead. This should be undertaken by an appropriately trained practitioner. Intracardiac potassium chloride is the recommended method and the dose should ensure that fetal asystole has been achieved" [3,4].

With improvements in the resolution of ultrasound examinations, the sophistication of prenatal diagnostic techniques [5] and an emphasis on eugenics, an increasing number of LTOPs are now performed. Because LTOP is not legal in some countries, no global statistical data are available. In Australia, a report in 1995 [6] indicated that pregnancy termination was performed after the diagnosis of fetal abnormalities in 3 per 1,000 births. In the United Kingdom, a report in 1994 [7] estimated the proportions of terminations performed at 20–24 weeks' gestation and at 25 weeks or above to be 1.2% and 0.05%, respectively. In Israel, where elective abortion is allowed up to 24 weeks gestation, 9% of abortions are performed in the second trimester, and about 1% in the third trimester [8].

The common practice for feticide involves injecting potassium chloride into the fetal heart to induce fetal asystole. However, the risk of maternal toxicity due to leakage of potassium chloride into the maternal circulation cannot be eliminated. We describe a new method of feticide by injection of normal saline into the fetal pericardial space to induce artificial fetal cardiac tamponade.

Case Report

A 32-year-old, gravida 6, para 2, abortus 3, woman with a poor obstetric history was known to be a balanced translocation carrier [45,XX,der(2),t(2,22)]. Her first pregnancy ended at 10 weeks owing to intrauterine fetal demise. Her second pregnancy resulted in a live birth at 39 weeks' gestation, but the infant died on the seventh postnatal day due to complex heart disease. Her third pregnancy was terminated at 22 weeks' gestation because of the detection of an unbalanced translocation. Chorionic villus sampling (CVS) was performed during her fourth pregnancy. An unbalanced translocation was again detected in this fetus and the pregnancy was terminated at 13 weeks. Her fifth pregnancy ended at 7 weeks owing to missed abortion, in which the karyotyping was normal. During the studied pregnancy, CVS was performed at 12 weeks' gestation when the pregnancy was confirmed. The analysis revealed a balanced translocation, the same as in the mother. The pregnancy was initially considered to be normal, but the fetus was subsequently found to be small for gestational age and microcephaly was detected. Amniocentesis was performed at 35 weeks' gestation, in case the previously detected balanced karyotype had been caused by maternal contamination during CVS. Karyotyping of the amniocytes disclosed 45,XX, der(2)t(2;22)(q37,q11.2)mat,–22. We counseled the patient and her husband regarding termination with feticide or the possibility of maintaining the pregnancy until delivery. They opted for feticide followed by LTOP. The mother was admitted to our ward for pregnancy termination at a gestational age of 36 weeks. A very low dose of potassium chloride (about 1–2 mL) was initially injected into the fetal heart under ultrasound guidance. Nevertheless, the patient felt immediate discomfort and fetomaternal circulation communication was suspected. The procedure was temporarily aborted until the patient recovered. Feticide was attempted again, using lidocaine instead of potassium chloride. However, the patient still experienced discomfort and the procedure was stopped again. Finally, after sending the patient to an operating theater for close cardiovascular and ventilatory surveillance, 0.9% sodium chloride was injected into the fetal pericardial space (Figure 1) to induce artificial cardiac tamponade (Figure 2). Fetal heart asystole was eventually confirmed. The patient felt no discomfort during this procedure. The patient then underwent hysterotomy, after giving informed consent. A female fetus weighing 2,495 g was delivered. Subsequent tissue chromosome analysis showed 45,XX,der(2)t(2;22)(q37,q11.2)mat,–22 karyotype, which confirmed the results of amniocentesis.

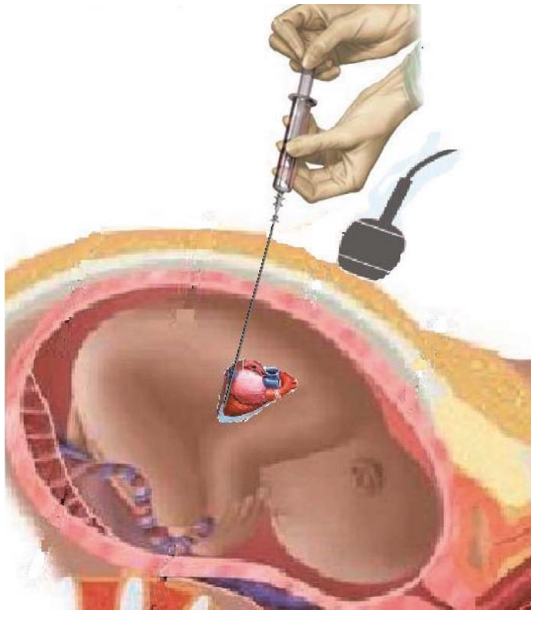

Figure 1. Procedure for injecting normal saline into the fetal pericardial space to achieve cardiac tamponade under ultrasound surveillance.

Discussion

Potassium chloride injection is the standard procedure for feticide. It was initially used by injection into the fetal heart, but this gave rise to concerns about fetal suffering [9,10]. To prevent potential fetal suffering, Senat et al [11] reported injecting potassium chloride into the umbilical vein. This extrafetal injection technique was reported to be successful in 86.7% of cases performed at 18–32 weeks' gestation [12]. The increased maternal volume of distribution and pregnancy-related physiologic changes both provide protection for the mother against the systemic toxicity of potassium chloride, but accidental maternal injection cannot be completely avoided. In addition, potassium chloride was reported to hasten tissue autolysis and increase the difficulty of central nervous system autopsy or microscopy [12]. Lidocaine injection into the umbilical vein was introduced as an alternative. This drug was reported to effectively induce fetal asystole and was thus less dangerous for the mother, because the amount crossing the placenta would be below the toxic dose. Even in the event of inadvertent maternal injection, the dose would still be safe for the mother.

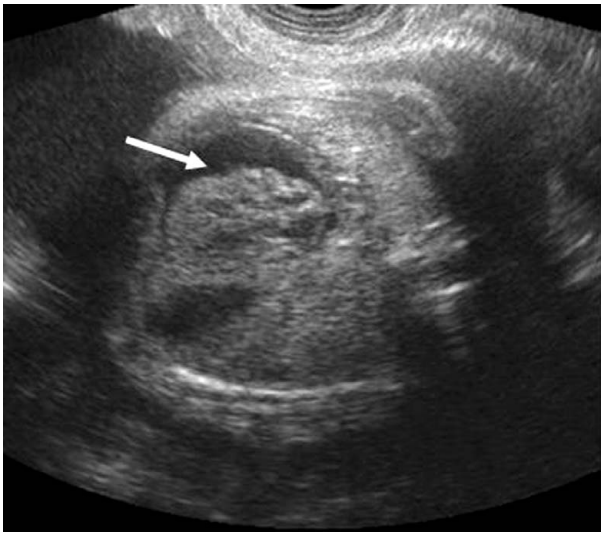

Figure 2. Artificial pericardial effusion (arrow), lying between the fetal mediastinum/lungs and the fetal heart.

A success rate of 92% was described for administration at 20–36 weeks [13]. In the present case, the patient experienced discomfort despite the minimal dose of potassium chloride or lidocaine. Other agents have also been used for induction of fetal asystole, including digoxin and hyperosmolar urea, administered intracardially [14]. The various methods of feticide reported in the literature are listed in the Table.

Whether or not fetuses are conscious and able to feel pain is a controversial issue. It has been suggested that fetuses may have the biological capacity to experience pain from 24 weeks' gestation onwards. Some authors, therefore, proposed that fetal analgesia should be provided prior to the feticide procedure [15–18]. A single umbilical vein puncture and administration of 5 μg of sufentanil prior to feticide with potassium chloride or lidocaine has been reported [11,13].

Ethical and legal issues often occur during the decision-making process leading to feticide. The uncertain prognosis of many fetal disorders or abnormalities sometimes results in the late termination of fetuses that appeared normal earlier in gestation. However, late termination challenges the law in many countries. The gestational threshold was set at 24 weeks in the 1967 Abortion Act in the United Kingdom. However, since 1991, UK abortion law states that: "a person shall not be guilty of an offence under the law relating to an abortion when a pregnancy is terminated by a registered medical practitioner if two medical practitioners are of an opinion formed in good faith that there is a substantial risk that if the child were born it would suffer from such physical or mental abnormalities as to be seriously handicapped" [19]. This breakthrough made LTOP during the third trimester legal. However, the laws governing pregnancy termination vary from country to country. In some European countries such as France, England, Wales, Belgium, Norway, Sweden and Finland, there is no gestational limit to termination under certain circumstances, such as lethal or severe fetal anomalies. The same attitude is reflected in other parts of the world, such as Israel, India, Cuba, Canada, Australia, and a few states in the United States [20]. However, there are no legal regulations governing the

Table. Previously reported methods of feticide in late termination

	Agent	Method	Gestational age (wk)	Successful cases (*n*)
Isada et al [9]	Potassium chloride (2 mEq/mL), 3–5 mL	Intracardiac	19–24	20/21
Senat et al [11]	Potassium chloride (20%), 10 mL	Through umbilical vein	22–38	10/10
Senat et al [13]	Lidocaine (1%), 7–30 mL	Through umbilical vein	20–36	46/50
Hern et al [14]	Digoxin 1.5 mg or hyperosmolar urea	Intracardiac	25–34	54/54

upper limit of gestational age for pregnancy termination in Taiwan, though international guidelines are usually followed. Thus, LTOP is legal for some conditions, such as lethal or chromosomal abnormalities, as explained by the Taiwan Association for Obstetrics and Gynecology [21].

The ethical controversy surrounding LTOP focuses on the rights of the fetus. Is the fetus a patient? Should we have the right to deprive them of their live? This dilemma concerns physicians. Chiang [21], from Taipei Mackay Memorial Hospital, provided an excellent review of late feticide, including a list of the categories of abnormalities that could justify feticide, and which should be strictly followed in this country.

In conclusion, live birth is not allowed in LTOP, and an effective and safe method of feticide prior to late termination is, therefore, necessary. Considering the potential adverse consequences to the mother of drug mal-injection and cross-circulation between the maternal–placental compartments during gestation, we chose to inject normal saline into the fetal pericardial space to induce artificial cardiac tamponade as an alternative method of feticide associated with minimal maternal risk. Late feticide has been preceded by fetal analgesia since 2008 in our institution, but further studies are required to determine the need for this procedure.

References

1. Evans MI, Fletcher JC, Zador IE, Newton BW, Quigg MH, Struyk CD. Selective first-trimester termination in octuplet and quadruplet pregnancies: clinical and ethical issues. *Obstet Gynecol* 1988;71:289–96.
2. Dumez Y, Oury JF. Method of first trimester selective abortion in multiple pregnancy. *Contrib Gynecol Obstet* 1986;15:50–3.
3. Royal College of Obstetricians and Gynaecologists. *Termination of Pregnancy for Fetal Anomaly in England, Wales and Scotland*. London: RCOG Press, 1996.
4. Royal College of Obstetricians and Gynaecologists. *Further Issues Relating to Late Abortion, Fetal Viability and Registration of Birth and Deaths*. London: RCOG Press, 2001.
5. Wyatt J. Medical paternalism and the fetus. *J Med Ethics* 2001;27(Suppl 2):ii15–20.
6. Beischer NA. Major fetal malformations and perinatal mortality rates: the place of late terminations. *Aust N Z J Obstet Gynaecol* 1995;35:1–2.
7. Paintin D. Abortion after 24 weeks. *Br J Obstet Gynaecol* 1997;104:398–400.
8. Kandel I, Merrick J. Late termination of pregnancy: professional dilemmas. *Scientific World Journal* 2003;3:903–12.
9. Isada NB, Pryde PG, Johnson MP, Hallak M, Blessed WB, Evans MI. Fetal intracardiac potassium chloride injection to avoid the hopeless resuscitation of an abnormal abortus, I: clinical issues. *Obstet Gynecol* 1992;80:296–9.
10. Fletcher JC, Isada NB, Pryde PG, Johnson MP, Evans MI. Fetal intracardiac potassium chloride injection to avoid the hopeless resuscitation of an abnormal abortus, II: ethical issues. *Obstet Gynecol* 1992;80:310–13.
11. Senat MV, Fischer C, Ville Y. Funipuncture for fetocide in late termination of pregnancy. *Prenat Diagn* 2002;22:354–6.
12. Gill P, Cyr D, Afrakhtah M, Mack L, Easterling T. Induction of fetal demise in advanced pregnancy terminations: report on a funic potassium chloride protocol. *Fetal Diagn Ther* 1994;9:278–82.
13. Senat MV, Fischer C, Bernard JP, Ville Y. The use of lidocaine for fetocide in late termination of pregnancy. *BJOG* 2003; 110:296–300.
14. Hern W, Zen C, Ferguson K, Hart V, Haseman M. Outpatient abortion for fetal anomaly and fetal death from 15–34 menstrual week's gestation: techniques and clinical management. *Obstet Gynecol* 1993;81:301–6.
15. Mrzljak L, Uylings HB, Kostovic I, Van Eden CG. Prenatal development of neurons in the human prefrontal cortex, I: a qualitative Golgi study. *J Comp Neurol* 1988;271:355–86.
16. Glover V, Fisk NM. Fetal pain: implications for research and practice. *Br J Obstet Gynaecol* 1999;106:881–6.
17. Smith R, Gitau R, Glover V, Fisk NM. Pain and stress in the human fetus. *Eur J Obstet Gynecol Reprod Biol* 2000;92:161–5.
18. Royal College of Obstetricians and Gynaecologists. *Fetal Awareness: Report of a Working Party*. London: RCOG Press, 1997.
19. Statham H, Solomou W, Green J. Late termination of pregnancy: law, policy and decision making in four English fetal medicine units. *BJOG* 2006;113:1402–11.
20. Ville Y, Cabaret AS. Late termination of pregnancy for fetal anomaly. *Fetal Matern Med Rev* 2005;16:265–79.
21. Chiang S. Late abortion: a comprehensive review. *Taiwan J Obstet Gynecol* 2005;44:318–26.