SHORT REPORT

Primary care fetal assessment — low-cost fetal arousal testing

G J Hofmeyr, T Lawrie, M de Jager

Conventional vibro-acoustic stimulation tests require expensive vibro-acoustic stimulators and electronic monitoring equipment. Attempts to simplify the test have been made using an electric toothbrush and razor but even these simpler devices are not available in most primary care settings. We compared the sound pressure generated by a Corometrics 146 vibro-acoustic stimulator to that of an empty soft-drink can in an *in vitro* study. The can compared favourably to the conventional vibro-acoustic stimulator.

S Afr Med J 1997; **87:** 171-172.

Assessment of fetal well-being forms an important part of prenatal care. Education of mothers about the importance of fetal movements is used to screen for fetal distress, and serial measurements of the symphysis-fundus distance are used to assess fetal growth.[1] When confirmation of fetal well-being is required, e.g. because of reduced movements or poor growth, the main diagnostic test used is cardiotocography (the non-stress test). The time required for non-stress testing may be reduced by means of the acoustic stimulation test.[2,3]

However, these tests require expensive electronic monitoring equipment and fetal acoustic stimulators, which are not available in most obstetric primary care settings. Attempts to simplify the testing procedure have included the use of maternal perception of evoked fetal movements rather than fetal heart rate tracings,[4-6] and replacement of the purpose-built vibro-acoustic stimulator by an electric toothbrush or razor.[7] Even the latter simple devices are not available in most primary care settings, may be difficult to obtain, need to be protected from theft, and may not have working batteries when needed.

We therefore investigated the possibility of using a simple, non-electric, readily available device for fetal arousal testing — an empty soft-drink can.

Department of Obstetrics and Gynaecology, Coronation Hospital and University of the Witwatersrand, Johannesburg

G J Hofmeyr, MRCOG

T Lawrie, MB BCh

M de Jager, MCur

Materials and methods

An *in vitro* experiment was set up to compare a soft-drink can and a commercially available fetal acoustic stimulator in respect of the sound pressure generated.

To simulate the attenuation of the sound through tissue and fluid when it passes into the intra-uterine environment, a model was constructed with a tissue layer consisting of an approximately 30 mm thick freshly delivered placenta above a 30 mm layer of normal saline, separated by thin plastic membranes. Sound pressure was measured with a Brüel & Kjær type 2219 sound level meter (Brüel & Kjær, Denmark) in the 'slow' response mode. The sensor of the sound pressure meter was placed in contact with the plastic membrane below the fluid layer, and the sound stimulus applied directly to the membrane over the tissue layer.

The sound stimulus was applied randomly by means of a commercially available fetal acoustic stimulator (Model 146, Corometrics Medical Systems) and a random selection of empty aluminium soft-drink and beer cans of the type in which a ring is lifted to fold back an opening in the lid. The cans were held with the bottom against the model and the thumb and middle finger supporting the rim of the top of the can. The index fingertip was used to depress the ring opener of the can gently (< 5 mm) or completely against the lid and allow it to snap back, producing a sound. The tests with the cans were classified according to whether the sound made was 'rattling' or resonant, and whether the opener was depressed gently or completely (Table I).

Table I. Fetal acoustic stimulation testing with an empty soft-drink can — simulated intra-uterine sound pressure transmission through tissue and fluid medium (measured in dB A)

	No.	Mean	SD	Median	Range
Corometrics 146 fetal acoustic stimulator	22	68.7	2.1	69	64 - 72
Cans with resonant sound					
Firm flick	20	76.3	1.7	76	74 - 80
Gentle flick	25	67.5	1.8	68	64 - 71
Cans with rattling sound					
Firm flick	12	72.0	2.3	72.5	66 - 74
Gentle flick	7	64.5	1.1	64	63 - 66

Results

The sound pressure transmission through the simulated tissue and fluid medium was reasonably similar to that produced by the acoustic stimulator with all the various soft-drink cans used. The closest approximation to the acoustic stimulator was achieved with the use of cans that gave a resonant (musical) sound, with gentle depression of the ring opener to produce the sound. Most cans examined could be made to produce a resonant sound by moving the ring opener sideways to eliminate any rattling.

Discussion

In vitro testing has shown that the sound produced by a commercial fetal acoustic stimulator can be closely mimicked with an inexpensive, widely available device — an empty soft-drink can. We are proceeding with clinical evaluation of the device, using clinical end-points (operator perception of fetal movements and auscultated fetal heart rate accelerations). If the results of the clinical evaluation support the use of a soft-drink can as an acoustic stimulator, the benefits will be self-evident.

We acknowledge the MRC and Wits University Research Council for partial funding of this research project.

REFERENCES

1. Hofmeyr GJ, Pattinson R, Nikodem VC, Gulmezoglu AM. Charting fetal growth. *CHASA Journal of Comprehensive Health* 1994; **5:** 62-67.
2. Read JA, Miller FC. Fetal heart rate acceleration in response to acoustic stimulation as a measure of fetal well-being. *Am J Obstet Gynecol* 1977; **129:** 512-517.
3. Salamalekis E, Batalias L, Kassanos D, Loghis C, Pyrgiotis E, Zourlas PA. The acoustic stimulation test and antenatal cardiotocography as diagnostic tools in high risk pregnancies. *J Obstet Gynaecol* 1995; **15:** 292-294.
4. Luz NP. Auditory evoked response of the human fetus: simplified methodology. *J Perinat Med* 1991; **19:** 177-183.
5. Nyman M, Arulkumaran S, Jakobsson J, Westgren M. Vibro-acoustic stimulation in high-risk pregnancies; maternal perception of fetal movements, fetal heart rate and fetal outcome. *J Perinat Med* 1992; **20:** 267-274.
6. Strong TH, Jordan DL, Marden DW. The fetal recoil test. *Am J Obstet Gynecol* 1992; **167:** 1382-1383.
7. Davey DA, Dommisse J, MacNab M, Dacre D. The value of an auditory stimulatory test in antenatal fetal cardiotocography. *Eur J Obstet Gynecol Reprod Biol* 1984; **18:** 273-277.

Accepted 28 Aug 1996.