Ultrasound Obstet Gynecol 2006; **28**: 207–213
Published online 29 June 2006 in Wiley InterScience (www.interscience.wiley.com). **DOI:** 10.1002/uog.2801

Impact of the availability of sonography in the acute gynecology unit

Z. HAIDER*, G. CONDOUS*, A. KHALID*, E. KIRK*, F. MUKRI*, B. VAN CALSTER†, D. TIMMERMAN‡ and T. BOURNE*

**Acute Gynaecology Unit, St. George's Hospital, London, UK and †Department of Electrical Engineering (ESAT) and ‡Department of Obstetrics and Gynaecology, University Hospital Gasthuisberg, K.U. Leuven, Belgium*

KEYWORDS: emergency gynecology; pelvic pain; PID; transvaginal ultrasound

ABSTRACT

Objective *The initial assessment of acute gynecology patients is usually based on history and clinical examination and does not involve ultrasound. The aim of this study was to investigate the impact of the availability of transvaginal sonography at the time of initial assessment of the emergency gynecology patient.*

Methods *This was a prospective observational study carried out over a 5-month period in the acute gynecology unit of an inner London teaching hospital. Women were assessed in the routine manner by history-taking and clinical examination and questionnaires were completed by the doctors, including details of the intention to treat. Transvaginal ultrasound examinations were then performed and a second diagnosis and management plan were made utilizing the extra information from the scan. The plans for clinical management before and after the ultrasound examination were compared.*

Results *We originally recruited 1000 consecutive women to the study. The mean age was 31.1 (SD, 9.81) years. Complete data were available for 920 (92%). 84 (9.1%) women did not require a scan. Of the 521 women with a positive pregnancy test, 75.6% were reassured immediately that their pregnancy was intrauterine. 143 women (27.4%) were given the diagnosis of a suspected ectopic pregnancy before sonography, compared with 29 (5.6%) after. Following the ultrasound examination there was a change in clinical management in 54.1% of the women with a positive pregnancy test and a reduction in admissions (including inpatient theater admissions) (from 40.3% to 17.1%) and outpatient follow-up examinations (from 41.1% to 35.5%). In 90 (23.8%) non-pregnant women a significant ovarian cyst (> 5 cm) was suspected clinically; 28/90 (31.1%) were confirmed on sonography. Following the ultrasound examination there was a change in clinical management for 38.1% of non-pregnant women and a reduction in admissions (from 37.1% to 19.4%) and outpatient follow-up examinations (from 25.7% to 18.1%).*

Conclusion *It appears that the availability of transvaginal sonography at the time of initial assessment of emergency gynecology patients improves diagnostic accuracy and reduces unnecessary admissions and follow-up examinations. Copyright © 2006 ISUOG. Published by John Wiley & Sons, Ltd.*

INTRODUCTION

Transvaginal sonography (TVS) has an established role in the detection of gynecological pathology[1,2]. It is also of value in determining pregnancy location and in the management of early pregnancy complications[3,4]. Using TVS, the diagnosis of an ectopic pregnancy should in most cases be based on the positive visualization of a pregnancy outside the uterus; the sensitivity and specificity of TVS to detect ectopic pregnancy may be as high as 90.9% and 99.9%, respectively[5]. Ectopic pregnancy is the fourth most common cause of maternal death in the UK[6], thus the prompt, accurate diagnosis of this condition is important. Although the value of TVS in gynecological emergencies has been demonstrated in small cohorts, it has not been validated prospectively in large numbers[7]. In one study, TVS made a positive contribution to diagnosis and management in 91% of women[8]. It is also useful in the assessment of women presenting with abdominal pain to Accident and Emergency hospital departments[9]. However, the initial assessment of acute gynecology patients is usually based on history and clinical

Correspondence to: Miss Z. Haider, Acute Gynaecology Unit, St. George's Hospital, Blackshaw Road, Tooting, London, SW17 0QT, UK (e-mail: zara.marsh@tesco.net)

Accepted: 6 April 2006

examination and does not involve ultrasound, and there are few, if any, published data to support the use of routine ultrasound in acute gynecology patients at the time of their initial contact with an emergency gynecology service. The aim of this study was to determine the impact of the availability of TVS at the time of initial assessment of the emergency gynecology patient.

PATIENTS AND METHODS

This prospective observational study was carried out at St. George's Hospital, London, which is a large, inner city, teaching hospital and tertiary referral center. It covers an ethnically and socially diverse population of over 650 000. The Acute Gynaecology Unit (AGU) is an ultrasound-based unit that is open between 09.00 and 22.00 h every day and is staffed by specialist nurses and clinical fellows. The clinical fellows all have at least 2 years' experience in gynecology and are proficient at TVS. All early pregnancy and gynecological ultrasound scans referred to St. George's Hospital are performed in this department (23 000 per year). Women are referred to the AGU from general practitioners, Accident and Emergency, the genitourinary medicine department and other hospital teams. There are three designated day surgery lists per week, in which surgery for miscarriage, stable ectopic pregnancies, ovarian cysts and minor gynecological conditions are scheduled.

This study assessed all women who presented to the AGU with acute gynecological symptoms between 1st July 2004 and 28th November 2004. All clinical fellows were asked to perform a typical initial assessment based on history and clinical examination alone. This involved: completing data sheets (Figure 1) about the women attending the AGU, circling specific responses to questions about pregnancy and presenting symptoms (pain, bleeding, vaginal discharge, vomiting, pelvic mass, vulval swelling, postoperative complication and other); indicating the most likely diagnosis (from a choice of 18); deciding on one of seven possible management plans (admit, outpatient referral, early pregnancy unit (EPU) referral, day surgery unit, inpatient surgery, discharge or refer to another team). This information was recorded prospectively on the data sheet. A decision was then made whether to perform an ultrasound scan. All clinically stable women with a positive pregnancy test ('pregnant group') and all clinically stable women with any gynecological complaint ('non-pregnant group') other than a vulval disorder (e.g. Bartholins abscess) underwent an ultrasound examination as part of the study. The presence or absence of presumed blood in the pouch of Douglas was noted. Morrison's pouch was not examined. Women who were hemodynamically unstable (e.g. with a clinical diagnosis of an ectopic pregnancy) did not undergo a scan as this may have delayed emergency surgery.

In those women in whom a scan was carried out, the clinical fellow was asked to make a second diagnosis and management plan utilizing the extra information available from the scan. This information was also recorded on the data sheet and the data were then transferred onto a Microsoft Excel spreadsheet. Patients who arrived after 22.00 h (when the AGU was closed) were seen by the resident on call who covered both obstetrics and gynecology. If a scan was indicated then this was performed within 24 h of admission and the patient entered into the study.

Statistical analysis

The women were divided into pregnant and non-pregnant groups. Change in management plan as a consequence of information provided by the ultrasound scan was analyzed using a modified Wald procedure to provide 95% CIs. A modified Wald test was used to compare the percentage change in management plan between the pregnant and non-pregnant groups.

RESULTS

Data sheets were completed for 920 (92%) of 1000 consecutive women who presented to the AGU during the study period. Their mean age was 31.1 (SD, 9.81) years (Table 1). 542/920 (58.9%) women attending the AGU had a positive pregnancy test and 378/920 (41.1%) were not pregnant.

Pregnant group

Of the 542 women who were pregnant, 521 (96.1%) had a scan. 394/521 women (75.6%) were reassured immediately that they had an intrauterine pregnancy. 143/521 (27.4%) women, on the basis of history and examination alone, were suspected of having an ectopic pregnancy. Of these, after TVS 65 (45.5%) were reassured that the location of the pregnancy was intrauterine, 53 (37.1%) had a pregnancy of unknown location (PUL; no pregnancy was identified either inside or outside the uterus) and were referred to the EPU for appropriate follow-up, and 25 had the diagnosis of ectopic pregnancy confirmed.

A total of 29 women had a presumed ectopic pregnancy visualized with TVS during the study, four of which had not been suspected clinically. 14/29 had a hemoperitoneum visualized sonographically (13/14 required surgery and one received methotrexate). Of the 15/29 who did not have a hemoperitoneum visualized, only eight required surgery. Overall, 21/29

Table 1 Age distribution of 1000 consecutive women attending the acute gynecology unit

Age (years)	*Number of women*
13–20	96
21–30	434
31–40	354
41–50	84
51–60	16
61+	16

DATA SHEET AGU

Name: Date: DOB:

Ref by – 1. GP 2. EPU 3. A&E 4. Ward 5. Walk in centre
6. Another team 7. GUM

Pregnant – 1. Yes 2. No

Symptoms – 1. Pain 2. Bleeding 3. Discharge 4. Vomiting 5. Pelvic mass
6.Vulval swelling 7. Post op complication 8. Other-specify_____

Scan indicated – 1. Yes 2. No

Diagnosis-based on history, examination (including vaginal examination)
1. Ectopic 2. Threatened 3. Incomplete 4. Complete
5. RPOC post TOP/ERPC/post partum 6. Hyperemesis 7. Ovarian cyst
8. UTI 9. Appendix 10. Musculoskeletal 11. GI 12. Bartholins/labial abscess
13. Menorrhagia/DUB 14. PID 15. PMB 16. Post op comp
17. Endometritis 18. Other-specify_____

What would your plan be on these findings alone?
1. Admit 2. OPD 3. EPU 4. DSU 5. IP Theatre
6. Discharge/No F/U 7. Refer to another team

Any other treatments?
1. Antibiotics 2. Analgesia 3. Anti emetics 4. DUB treatments
5. None 6. Other-specify _____

Scan findings
1. Normal 2. Ovarian cyst 3. Hydrosalpinx 4. Tubo-ovarian mass
5. Endometrial polyp 6. Fibroids 7. EIUP 8. IUP 9. PUL
10. Ectopic 11. RPOC 12. Multiple pregnancy
13. Other-specify_____

Diagnosis after history, examination and USS?
1. Ectopic 2. EIUP/IUP 3. RPOC (incomplete/post op/post partum)
4. Hyperemesis 5. Ovarian cyst 6. UTI 7. Appendix 8. Musculoskeletal
9. GI 10. Bartholins 11. Menorrhagia/DUB 12. PID
13. Post op complication 14. Endometritis 15. Other-specify_____

What would your plan be on these findings?
1. Admit 2. OPD 3. EPU 4. DSU 5. IP Theatre
6. Discharge/No F/U 7. Refer to another team

Any other treatments?
1. Antibiotics 2. Analgesia 3. Anti emetics 4. DUB treatments
5. None 6. Other-specify_____

Chlamydia screened 1. Yes 2. No

Name of Doctor 1. ZH 2. EK 3. AS 4. VP 5. FS 6. AF 7. TA

Figure 1 Data sheet. A&E, accident and emergency department; EPU, early pregnancy unit; GP, general practitioner; GUM, genitourinary medicine department; RPOC, retained products of conception; TOP, termination of pregnancy; ERPC, evacuation of retained products of conception; UTI, urinary tract infection; GI, gastrointestinal problems; DUB, dysfunctional uterine bleeding; PID, pelvic inflammatory disease; DSU, day surgery unit; IP, inpatient; F/U, follow-up; IUP, intrauterine pregnancy; EIUP, early intrauterine pregnancy; OPD, outpatient department; PMB, postmenopausal bleeding; PUL, pregnancy of unknown location; USS, ultrasound scan.

required surgery. Twenty had an ectopic pregnancy confirmed at the time of surgery and there was one negative laparoscopy. Seven of the remaining patients were managed conservatively (two women with a tubal and one with a cornual ectopic pregnancy had systemic methotrexate, one with a Cesarean section scar ectopic pregnancy had intra-amniotic methotrexate and three with tubal ectopic pregnancies were managed expectantly). One of the 29, on follow-up scan, was found to have an intrauterine pregnancy.

The majority of pregnant women complained of pelvic pain, vaginal bleeding or both ($n = 466$). The change in management plan after ultrasound was performed in this population, divided according to these main presenting complaints, is shown in Tables 2–4. The original management plan was changed after the ultrasound scan

Table 2 Change in management plan after transvaginal sonography was performed in pregnant women presenting with pelvic pain ($n = 167$)

Management plan before ultrasound	*Number of women*	*Management plan after ultrasound*	*Number of women*
Admit	57	Admit	11
		Outpatient appt.	23
		Theater (EP)	2
		Discharge	21
Outpatient appt.	44	Admit	1
		Outpatient appt.	19
		Theater (ERPC)	2
		Discharge	21
		Refer	1
Theater	40	Admit	4
		Outpatient appt.	16
		Theater (EP)	11
		Discharge	9
Discharge	25	Outpatient appt.	2
		Discharge	22
		Refer	1
Refer	1	Refer	1

appt., appointment; EP, surgery for removal of ectopic pregnancy; ERPC, evacuation of retained products of conception.

Table 3 Change in management plan after transvaginal sonography was performed in pregnant women presenting with vaginal bleeding ($n = 178$)

Management plan before ultrasound	*Number of women*	*Management plan after ultrasound*	*Number of women*
Admit	26	Admit	4
		Outpatient appt.	10
		Theater (ERPC)	1
		Discharge	11
Outpatient appt.	103	Admit	2
		Outpatient appt.	54
		Theater (ERPC)	6
		Discharge	40
		Refer	1
Theater	8	Admit	1
		Outpatient appt.	3
		Theater (1 EP, 3 ERPC)	4
Discharge	40	Admit	1
		Outpatient appt.	11
		Theater (ERPC)	2
		Discharge	26
Refer	1	Discharge	1

appt., appointment; EP, surgery for removal of ectopic pregnancy; ERPC, evacuation of retained products of conception.

($n = 521$) in 54.1% of pregnant women. The 95% CI, using a modified Wald procedure[10], was 49.8–58.4%. Based on history and examination alone, 210 of the 521 (40.3%) pregnant women who were later scanned would have been admitted immediately, but in fact 89 (17.1%) were admitted after the scan had been performed. Similarly, the percentage of outpatient referrals based on history and examination alone would have been 41.1%

Table 4 Change in management plan after transvaginal sonography was performed in pregnant women presenting with pain and bleeding ($n = 121$)

Management plan before ultrasound	*Number of women*	*Management plan after ultrasound*	*Number of women*
Admit	39	Admit	15
		Outpatient appt.	9
		Theater (ERPC)	1
		Discharge	14
Outpatient appt.	53	Admit	3
		Outpatient appt.	24
		Theater (ERPC)	2
		Discharge	24
Theater	19	Admit	1
		Outpatient appt.	6
		Theater (3 EP, 3 ERPC)	6
		Discharge	6
Discharge	10	Outpatient appt.	2
		Theater (1 EP, 1 ERPC)	2
		Discharge	6

appt., appointment; EP, surgery for removal of ectopic pregnancy; ERPC, evacuation of retained products of conception.

Table 5 Overall results for change in management plan for pregnant group ($n = 521$)

Management plan	*Number of women under management plan*		*Number of women with plan unchanged after TVS*
	Before TVS	*After TVS*	
Admit	158	73	59
Outpatient appt.	214	185	101
Day surgery	16	24	13
Inpatient theater	52	16	9
Discharge	76	218	55
Refer to another team	5	5	2
Total	521	521	239

appt., appointment; TVS, transvaginal sonography.

(214/521), but after sonography 35.5% (185/521) were referred (Table 5).

Non-pregnant group

Of the 378 women who were not pregnant, 315 had an ultrasound scan. The majority of the non-pregnant women complained of pelvic pain, vaginal bleeding or both ($n = 294$). The change in management plan after sonography in this population, divided according to these main presenting complaints, is shown in Tables 6–8. The original management plan was changed after the ultrasound scan in 38.1% of these 315 cases (modified Wald 95% CI, 32.9–43.6%). Based on history and examination alone the rate of admissions would have been 37.1% (117/315) but following TVS it was in fact 19.4% (61/315), and the outpatient follow-up rate would have been 25.7% (81/315) but following TVS it was

Table 6 Change in management plan after transvaginal sonography was performed in non-pregnant women presenting with pelvic pain ($n = 190$)

Management plan before ultrasound	*Number of women*	*Management plan after ultrasound*	*Number of women*
Admit	79	Admit	35
		Outpatient appt.	3
		Theater (ovarian cyst)	1
		Discharge	18
		Refer	22
Outpatient appt.	38	Admit	1
		Outpatient appt.	21
		Discharge	12
		Refer	4
Theater	5	Admit	1
		Theater (ovarian cyst)	2
		Discharge	1
		Refer	1
Discharge	39	Admit	1
		Outpatient appt.	3
		Discharge	35
Refer	29	Admit	2
		Outpatient appt.	1
		Discharge	2
		Refer	24

appt., appointment.

Table 7 Change in management plan after transvaginal sonography was performed in non-pregnant women presenting with vaginal bleeding ($n = 69$)

Management plan before ultrasound	*Number of women*	*Management plan after ultrasound*	*Number of women*
Admit	14	Admit	7
		Discharge	5
		Refer	2
Outpatient appt.	24	Outpatient appt.	15
		Theater (polypectomy)	1
		Discharge	6
		Refer	2
Theater	16	Theater (4 ERPC, 2 hysteroscopy, 2 polypectomy)	8
		Discharge	8
Discharge	14	Outpatient appt.	2
		Discharge	12
Refer	1	Refer	1

appt., appointment; ERPC, evacuation of retained products of conception.

18.1% (57/315) (Table 9). A modified Wald test for the difference in percentages[11] indicated that the percentage change was significantly less for non-pregnant women compared with pregnant women (difference = 16.0%; modified Wald 95% CI, 9.1–22.8%, $P < 0.0001$). The majority of non-pregnant women (202/378 (53.4%)) presented with pelvic pain of these, 190/202 (94.1%) underwent TVS (Table 6). Seventy-nine of these women were thought to warrant admission before the scan was performed. After the scan, 35/79 were admitted, 18 were discharged (15 with a normal scan, one had a small ovarian cyst and two had fibroids) and 22 were referred to other hospital teams. 90/315 (28.6%) of the non-pregnant women who underwent sonography were discharged from the AGU after having a normal scan (i.e. no gynecological pathology detected).

Table 8 Change in management plan after transvaginal sonography was performed in non-pregnant women presenting with pain and bleeding ($n = 35$)

Management plan before ultrasound	*Number of women*	*Management plan after ultrasound*	*Number of women*
Admit	8	Admit	4
		Outpatient appt.	1
		Theater (ERPC)	1
		Discharge	2
Outpatient appt.	15	Outpatient appt.	8
		Discharge	6
		Refer	1
Theater	5	Outpatient appt.	1
		Theater (ERPC)	3
		Discharge	1
Discharge	6	Outpatient appt.	1
		Discharge	5
Refer	1	Refer	1

appt., appointment; ERPC, evacuation of retained products of conception.

Table 9 Overall results for change in management plan for non-pregnant group ($n = 315$)

Management plan	*Number of women under management plan*		*Number of women with plan unchanged after TVS*
	Before TVS	*After TVS*	
Admit	109	56	50
Outpatient appt.	81	57	46
Day surgery	19	12	9
Inpatient theater	8	5	4
Discharge	64	121	57
Refer to another team	34	64	29
Total	315	315	195

appt., appointment; TVS, transvaginal sonography.

To ascertain the final outcome for the 90 non-pregnant women discharged after a normal scan, a structured telephone follow-up consultation was conducted after 1 year. Seventeen patients were lost to follow-up. Of the 73 (81.1%) who were contacted, 56 had originally presented with pelvic pain, 10 had presented with bleeding and seven had presented with both pain and bleeding. Two women had undergone surgery elsewhere in the month after attending the AGU; one had an evacuation of retained products of conception after complaining of persistent bleeding post-delivery and one was readmitted with persistent pelvic pain and subsequently had a

negative diagnostic laparoscopy. Two women had sought second opinions in the month after attending the AGU; one was diagnosed with presumed pelvic inflammatory disease (PID) and the other with a probable ruptured ovarian cyst. Neither required admission or surgical intervention. Of the 73 non-pregnant women with complete follow-up a year after discharge from the AGU after a normal scan, 69 (94.5%) did not require further treatment, admission or surgical intervention relating to their presenting complaint. Of the 17 women lost to follow-up there is no record of any reattending our hospital in the year since their attendance at the AGU.

All 20 of the women who were clinically diagnosed in the AGU as having appendicitis had normal findings on TVS. All were referred to the general surgeons and 15 underwent surgery. Appendicitis was confirmed in nine, and one had an infarcted appendix epiploica. No other significant pathology was found in 10 of these women.

Thirty-five non-pregnant women were thought to have PID based on history and examination alone (31 presented with pelvic pain and four with pelvic pain and bleeding). After sonography, 26/35 were still thought to have PID. Three women initially thought to have ovarian cysts prior to a scan were diagnosed with PID after two were found to have a tubo-ovarian mass and one a hydrosalpinx. Four women with a suspected ovarian cyst and one with a suspected urinary tract infection were found to have no obvious pathology on sonography, but were found to have pelvic tenderness during the scan, and reassessment of the clinical presentation led to them being diagnosed with PID. Therefore, after clinical assessment and a TVS, 34 women in this study were diagnosed with PID. Of these 24/34 women had a normal scan. Ten had pathology visualized on sonography (three had a hydrosalpinx and seven a tubo-ovarian mass).

Twenty-eight women were found on sonography to have a significant (> 5 cm diameter) ovarian cyst (90 were suspected prior to TVS). Nine women with suspected ovarian cysts on ultrasound required surgery and a cyst was confirmed in eight (the remaining patient had a salpingectomy for a large hydrosalpinx). Five other women who were thought to have a significant cyst prior to a scan were found to have fibroids.

DISCUSSION

This is the first study to validate prospectively the use of an ultrasound examination in the management of women attending an acute gynecology unit. The availability of sonography in the emergency gynecology setting led to changes in management plan and a reduction in the number of admissions and outpatient referrals for both pregnant and non-pregnant women.

Changes in management plan because of ultrasound findings occurred more in the pregnant than in the non-pregnant group ($P < 0.0001$). When the viability and/or the location of a pregnancy are unknown, TVS quickly reassures both the woman and the clinician. 45.5% of women suspected of having an ectopic pregnancy were reassured, after scanning, that their pregnancies were intrauterine. Twenty-nine women had presumed ectopic pregnancies visualized on TVS during the study. Of those ectopic pregnancies managed surgically, 95.2% (20/21) were diagnosed correctly preoperatively using TVS alone, which is in keeping with published data[5]. The prevalence of PULs in this AGU population was 10% (53/521), which again is consistent with data from early pregnancy populations[12].

We found that in most circumstances the clinician believed that an ultrasound scan was indicated. In the UK it is not unusual to admit women overnight with early pregnancy problems solely because they need an ultrasound scan which cannot be performed until the following day. During the time of this study, 99 women would have been admitted unnecessarily to await further investigations. This has obvious cost and bed occupancy implications.

The majority of the non-pregnant women with pelvic pain and/or bleeding had a scan at the time of consultation. We attempted to follow up the 90 non-pregnant women who were discharged from the AGU after a normal scan. However, obtaining accurate follow-up data on these women was difficult, as our hospital caters for a transient inner city population. We were unable to obtain follow-up data on 17 women and whilst they did not subsequently attend our hospital, we acknowledge that we cannot exclude the possibility that they required treatment elsewhere. However, telephone follow-up of the residual 73 (81.1%) non-pregnant women who were discharged from the AGU suggests that a normal scan has a high negative predictive value for the presence of serious pathology. In the year following the consultation in the AGU only two required surgical intervention, and one of these procedures was a negative laparoscopy.

All 20 women suspected of having appendicitis on presentation to the AGU had a normal transvaginal scan. 14/20 required surgery and in nine the diagnosis was confirmed. The possibility of diagnosing appendicitis on an ultrasound scan (an inflamed appendix seen as a non-compressible, gas-containing tubular structure) has been reported[13]. Our data suggest there is a gap in the training for gynecological sonography, as it is probable that some of these cases could have been visualized on sonography. 62/90 women in whom a significant ovarian cyst was suspected prior to sonography could be reassured quickly that they did not have such pathology. Those that did have an ovarian cyst of > 5 cm diameter were triaged appropriately (surgery, or TVS follow-up) depending on the nature of the cyst and their clinical symptoms. Twenty-eight women had a cyst confirmed sonographically and nine underwent surgery. Of these, all but one was confirmed. In this case, a large hydrosalpinx (a known differential diagnosis of an apparent ovarian cyst) was removed at laparoscopy (the patient complained of unilateral pelvic pain). Fifty-nine non-pregnant women would have been admitted unnecessarily during the period of this study, with cost and bed occupancy implications.

We acknowledge that this study is limited by the fact that it was based on the clinician's 'intention to treat' and that there was a certain diagnostic suspicion bias. However, sonography is not and should not be used in isolation. More information could be gained by assessing the impact of ultrasound before and after its introduction into an acute gynecology service. This was not done, as the corresponding data in acute gynecological women before the introduction of the use of ultrasound were not recorded and therefore were not available for comparison. Notwithstanding these limitations, our data lend support to the view that having sonography available in the emergency gynecological setting improves the efficiency and, potentially, cost-effectiveness of the management of most acute gynecological conditions.

REFERENCES

1. Ubaldi F, Wisanto A, Camus M, Tournaye H, Clasen K, Devroey P. The role of transvaginal ultrasonography in the detection of pelvic pathologies in the infertility work up. *Hum Reprod* 1998; **13**: 330–333.
2. Taipale P, Tarjanne H, Ylostalo P. Transvaginal sonography in suspected pelvic inflammatory disease. *Ultrasound Obstet Gynecol* 1995; **6**: 430–434.
3. Bigrigg MA, Read MD. Management of women referred to early pregnancy assessment unit: care and cost effectiveness. *BMJ* 1991; **302**: 577–579.
4. Goldstein SR. Early detection of pathologic pregnancy by transvaginal sonography. *J Clin Ultrasound* 1990; **18**: 262–273.
5. Condous G, Okaro E, Khalid A, Lu C, Van Huffel S, Bourne T. The accuracy of transvaginal ultrasonography for the diagnosis of ectopic pregnancy prior to surgery. *Hum Reprod* 2005; **20**: 1404–1409.
6. Lewis G, Drife J (eds). *Why Mothers Die, Triennial Report 2000–2002. The Sixth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom*. RCOG Press: London, 2004.
7. Mould TA, Byrne DL, Morton KE. The role of ultrasound in gynaecological emergencies. *Ultrasound Obstet Gynecol* 1992; **2**: 121–123.
8. Nasri M, Setchell M, Chard T. Vaginal scans in acute gynaecology. *Lancet* 1990; **335**: 360–361.
9. McGrath FP, Keeling F. The role of early sonography in the management of the acute abdomen. *Clin Radiol* 1991; **44**: 172–174.
10. Agresti A, Coull BA. Approximate is better than "exact" for interval estimation of binomial proportions. *Am Stat* 1998; **52**: 119–126.
11. Agresti A, Caffo B. Simple and effective confidence intervals for proportions and differences of proportions result from adding two successes and two failures. *Am Stat* 2000; **54**: 280–288.
12. Condous G, Lu C, Van Huffel S, Timmerman D, Bourne T. Human chorionic gonadotrophin and progesterone levels in pregnancies of unknown location. *Int J Gynaecol Obstet* 2004; **86**: 351–357.
13. Molander P, Paavonen J, Jobber J, Savelli L, Cacciatore B. Transvaginal sonography in the diagnosis of acute appendicitis. *Ultrasound Obstet Gynecol* 2002; **20**: 496–501.

