

# Arteriovenous malformation of the uterus associated with secondary postpartum hemorrhage

S. M. KELLY\*, A. M. BELLI† and S. CAMPBELL\*

\*Department of Obstetrics and Gynaecology and †Department of Interventional Radiology, St George's Hospital, London, UK

**KEYWORDS:** arteriovenous malformation; color Doppler ultrasonography; arterial embolization

## 1 ABSTRACT

2 We present the case of a young woman with persistent  
 3 secondary postpartum hemorrhage. Transvaginal imaging  
 4 demonstrated an irregular pulsatile lesion in the anterior  
 5 myometrium. Color Doppler analysis revealed the pres-  
 6 ence of abnormal vessels consistent with an arteriovenous  
 7 malformation. Typically this vascular abnormality had a  
 8 turbulent pattern of arterial and venous flow with high  
 9 peak velocities and low resistance. The patient was treated  
 10 with selective arterial embolization leading to a full recov-  
 11 ery. Copyright © 2003 ISUOG. Published by John Wiley  
 12 & Sons, Ltd.  
 13

## 16 INTRODUCTION

17  
 18 Arteriovenous malformations of the uterus are rare  
 19 lesions although it is likely that hitherto they have been  
 20 underreported. Dubreuil and Loubat<sup>1</sup> reported the first  
 21 case in 1926 and there are around 30 more cases reported  
 22 in the literature. In most cases the lesions are acquired and  
 23 have been attributed to trophoblastic disease, previous  
 24 pelvic surgery or curettage, and cervical or endometrial  
 25 malignancy<sup>2,3</sup>. Some cases are thought to be congenital,  
 26 and in this situation the lesions may be multiple involving  
 27 other organs of the body.

28 The classical presentation of uterine arteriovenous  
 29 malformations is often one of severe uterine bleeding  
 30 with no obvious cause. Although a definitive diagnosis  
 31 is usually made by pelvic angiography, transvaginal  
 32 scanning with color Doppler provides a valuable, non-  
 33 invasive method of diagnosis<sup>4,5</sup>.

34 This report describes the association of an arteriove-  
 35 nous malformation with secondary postpartum hemor-  
 36 rhage in a young woman 1 month following Cesarean  
 37 section.  
 38

## CASE REPORT

39  
 40 This 36-year-old woman achieved a twin pregnancy  
 41 following her first cycle of *in vitro* fertilization for male  
 42 factor infertility. Her antenatal course was complicated  
 43 by one hospital admission for hyperemesis gravidarum at  
 44 10 weeks' gestation. Then at 23 weeks' gestation a routine  
 45 ultrasound scan detected a shortened cervix with obvious  
 46 funnelling. For this reason an emergency cervical cerclage  
 47 was performed without complication. The pregnancy  
 48 continued until 31 weeks' gestation when the patient  
 49 presented in preterm labor. In view of the patient's history  
 50 and at the parents' request an emergency Cesarean section  
 51 was performed. Both female fetuses were delivered in good  
 52 condition and were transferred to the neonatal unit and  
 53 were discharged approximately 4 weeks later.  
 54

55 The patient herself experienced a moderate intraopera-  
 56 tive blood loss but despite her postoperative hemoglobin  
 57 falling to 7.7 g/dL she declined transfusion. She was dis-  
 58 charged on the sixth postoperative day.

59 The patient was readmitted 19 days postoperatively  
 60 with a sudden and profuse vaginal bleed, which settled  
 61 spontaneously. At this point her hemoglobin was reported  
 62 as 8.5 g/dL. Based on clinical findings a presumptive  
 63 diagnosis of endometritis with possible retained products  
 64 of conception was made. Treatment in the form of  
 65 intravenous antibiotics was instituted (the patient again  
 66 declined a blood transfusion). A pelvic ultrasound scan  
 67 revealed the presence of a small area of probable retained  
 68 products of conception. An evacuation of the uterus was  
 69 advised but as the bleeding had appeared to have settled  
 70 the patient declined and continued conservative treatment  
 71 and was discharged. She was readmitted 24 h later with  
 72 a further profuse bleed. The hemoglobin was reported at  
 73 7.2 g/dL and the patient agreed to both transfusion and  
 74 evacuation of the uterus. The evacuation procedure was  
 75 performed with gentle digital exploration only and a small  
 76 amount of organized blood clot was removed. There were

Correspondence to: Dr S. M. Kelly, McGill Reproductive Center, 687 Pine Avenue West, Montreal, Quebec H3A 1A1, Canada  
 (e-mail: simon.kelly@muhc.mcgill.ca)

Accepted: 31 March 2003

1 no specific products of conception removed and sharp  
 2 curettage was not performed. Three days later whilst  
 3 visiting her babies in the neonatal unit she experienced  
 4 another large vaginal bleed, became hypotensive and  
 5 required a further blood transfusion. A transvaginal  
 6 scan performed demonstrated a large cystic area in the  
 7 anterior myometrium, which with the addition of color  
 8 Doppler showed typical features of an arteriovenous  
 9 malformation. Figure 1 shows the cystic spaces as seen  
 10 on gray scale imaging. Figure 2 shows the color Doppler  
 11 image demonstrating the arteriovenous malformation.  
 12 Pulsed Doppler analysis of the blood flow pattern  
 13 revealed typical features as seen with arteriovenous  
 14 fistulae formation. The waveform showed a broad spectral  
 15 envelope with continuous high-velocity flow throughout  
 16 systole and diastole (Figure 3). The peak systolic velocity  
 17 (PSV) was elevated (PSV = 97 cm/s) and the pulsatility  
 18 index (PI) low (PI = 0.39), illustrating a typical high  
 19 flow, low resistance, blood flow pattern (resistance  
 20 index (RI) = 0.32). The patient underwent a pelvic  
 21 angiogram with a view to selective embolization of the  
 22 arteriovenous malformation (Figure 4). It was discovered  
 23 that the malformation was fed predominantly by the right  
 24 uterine artery, which was selectively embolized with  
 25 a combination of Gelfoam® (Upjohn, Kalamazoo,  
 26 MI, •USA) and Embosphere Microspheres® (BioSphere  
 27 Medical, Inc., Rockland, MA, •USA). There appeared to  
 28 be no contribution from the left uterine artery therefore  
 29 this was not embolized.

30 The patient experienced some mild lower abdominal  
 31 discomfort and a low-grade fever for 2 days after the  
 32 procedure but made a full and uneventful recovery.  
 33 A repeat transvaginal scan performed 1 week later  
 34 demonstrated a significant change in appearance of the  
 35 malformation on gray scale imaging (Figure 5) and a  
 36 markedly reduced blood flow pattern with color Doppler  
 37 (Figure 6).

## DISCUSSION

41 Arteriovenous malformations arise by definition from an  
 42 abnormal communication between an artery and a vein.  
 43 Histological examination of these malformations usually  
 44 reveals a localized proliferation of both arterial and  
 45 venous vessels with interconnecting fistulae. Intertwining  
 46 these muscular vessels there are many thin-walled  
 47 capillary-type vessels. It has also been recognized that  
 48 the various proportions of different vessel types may vary<sup>6,7</sup>.  
 49 This fact most likely explains some of the variations seen  
 50 in Doppler waveform profiles from the various reported  
 51 cases of uterine arteriovenous malformations.

52 Although these vascular anomalies have been reported  
 53 in both adolescence and following the menopause, they  
 54 tend to occur predominantly in women of reproductive  
 55 age and very rarely in women who have not been pregnant.  
 56 In fact pregnancy appears to have an important role in the  
 57 pathogenesis of uterine arteriovenous malformations<sup>8</sup>. It  
 58 is postulated that these malformations may arise when  
 59 venous sinuses become incorporated in scars within

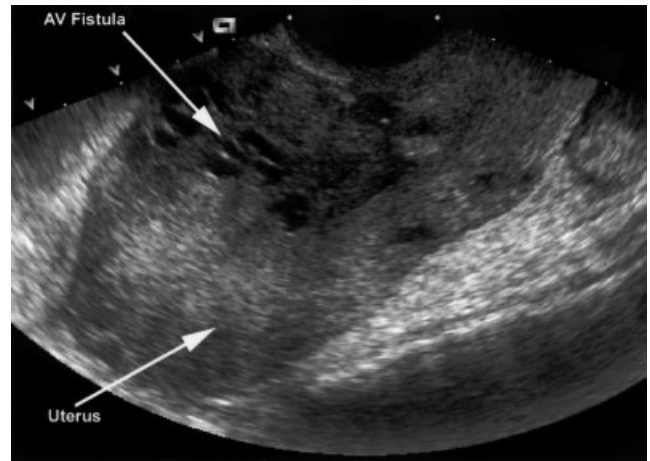


Figure 1 Gray scale image of the arteriovenous malformation with prominent cystic spaces within the myometrium.

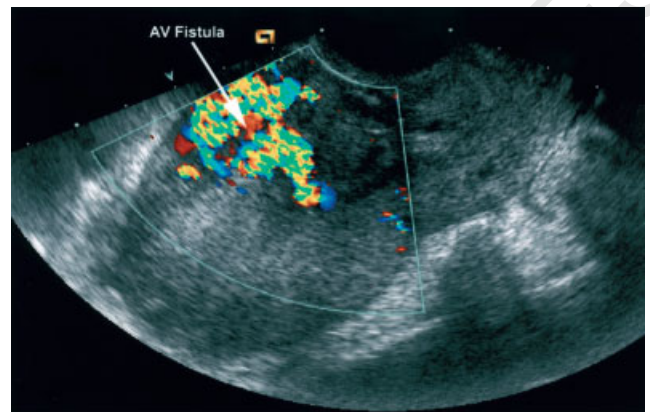


Figure 2 Color Doppler image of the arteriovenous malformation.

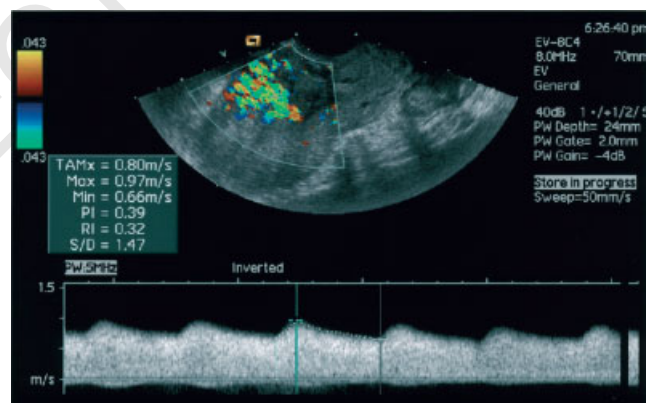
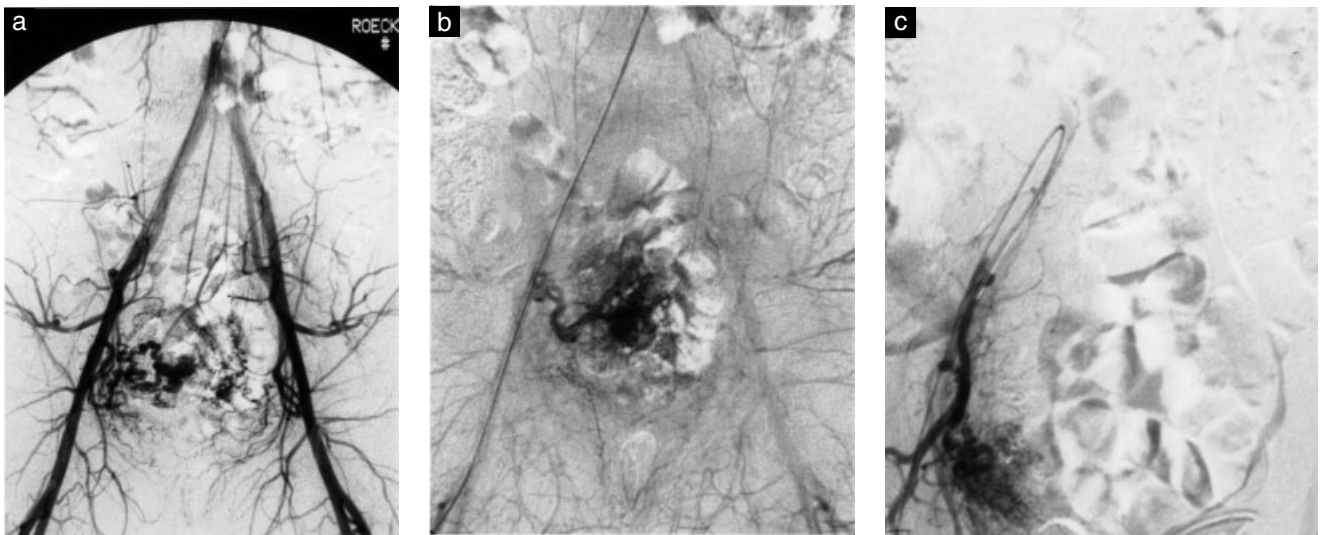


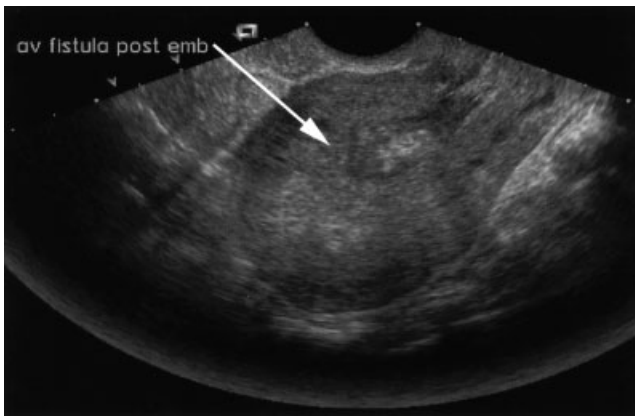
Figure 3 Pulsed Doppler image showing the broad spectral waveform with continuous flow throughout systole and diastole.

the myometrium after necrosis of the chorionic villi. This is also perhaps why there is an association with trophoblastic disease, in particular following treatment with chemotherapeutic agents.

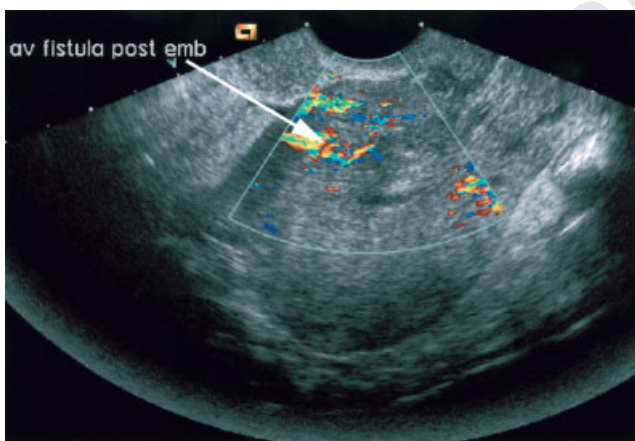
From a clinical perspective these vascular anomalies most commonly present with abnormal uterine bleeding. Rarely the patient may present with a pulsatile mass in the pelvis. The bleeding may be severe and result in



**Figure 4** Arteriograms pre- and post-embolization. (a) Early phase arteriogram showing filling of the uterine artery and the arteriovenous malformation. (b) Later phase of the same injection showing early filling of a prominent draining vein from the uterus. The tip of the catheter in (a) and (b) is in the tight internal iliac artery. (c) Post-embolization there is absence of filling of the occluded uterine artery.



**Figure 5** Gray scale image of the arteriovenous malformation following selective embolization.



**Figure 6** Color Doppler image following embolization showing the markedly reduced blood flow.

be disrupted. Treatment has often been in the form of hysterectomy.

Diagnosis of uterine arteriovenous malformations has traditionally proved difficult. Standard diagnostic procedures such as pelvic examination, hysteroscopy and gray scale ultrasonography have not proved to be adequately robust. The current gold standard method of diagnosis is pelvic angiography. This invasive procedure allows confirmation of the diagnosis but also helps to identify the leading 'feeder' vessels where embolization may be indicated as a conservative treatment option<sup>9,10</sup>.

Gray scale ultrasonography alone may play a role in diagnosis but the features of arteriovenous malformations may be similar to other pelvic structures or pathologies<sup>11</sup>. The addition of color Doppler improves the diagnostic ability of ultrasonography<sup>12</sup>. A localized area of increased vascularity within the myometrium itself typifies these lesions. Pulsed Doppler evaluation of the identified area will normally reveal a low-resistance blood flow with high peak velocities and evidence of turbulence. The waveform is usually broad with an irregular spectral envelope indicating a turbulent flow resulting from the many direct arteriovenous connections that are present. There is usually continuous high blood flow throughout both the systolic and diastolic components of the cardiac cycle. Analysis of the waveform will show a typically high PSV with low values for both the RI and PI.

Therefore the prime advantage of Doppler ultrasound is that it provides a non-invasive method of diagnosis of uterine arteriovenous malformations. Angiography can be reserved as a therapeutic option where selective embolization of the vessels feeding the malformation can be performed. The patient can then be asked to give consent for embolization prior to angiography, thereby avoiding the need for a second therapeutic procedure. Additionally, localization of the lesion by

1 significant anemia or even shock. Torrential bleeding may  
 2 follow uterine curettage as there is often only a thin layer  
 3 of endometrium overlying the malformation, which may  
 4  
 5

Color Figure - Print and Online

8  
9

1 prior Doppler ultrasound may aid the embolization  
2 procedure.

3 In our patient, the diagnosis of arteriovenous malfor-  
4 mation by color Doppler determined the correct approach  
5 to management, which was uterine artery embolization.  
6 Without a scan and color Doppler assessment it is prob-  
7 able that curettage would have been performed on the  
8 basis of the likely presence of retained products of con-  
9 ception with the risk of massive uterine hemorrhage. It is  
10 recommended that a transvaginal scan and color Doppler  
11 assessment should be performed on any woman with  
12 moderate to severe secondary postpartum hemorrhage to  
13 exclude this rare but dangerous abnormality.

## 16 REFERENCES

- 17 1. Dubreuil G, Loubat E. Aneurisme circoid de l'uterus. *Ann Anat*  
18 *Pathol* 1926; 3: 697–718.
- 19 2. Ggosh H. Arteriovenous malformation of the uterus and pelvis.  
20 *Obstet Gynecol* 1986; 68(Suppl.): 40–43.
- 21 3. Gaylis H, Levine E, van Dongen L, Katz M. Arteriovenous  
22 fistula after gynaecologic operations. *Surg Gynecol Obstet* 1973;  
23 137: 655–658.
4. Musa A, Hata T, Hata K, Kitao M. Pelvic arteriovenous 24  
malformation diagnosed by color flow Doppler imaging. *AJR*  
25 *Am J Roentgenol* 1989; 152: 1311–1312.
5. Müngen E, Yergök Y, Ertekin A, Ergür, Uçmakli E, Aytaçlar S. 26  
Color Doppler sonographic features of uterine arteriovenous  
27 malformations: a report of two cases. *Ultrasound Obstet*  
28 *Gynecol* 1997; 10: 215–219.
6. Fleming H, Östör A, Pickel H, Fortune D. Arteriovenous mal- 30  
formations of the uterus. *Obstet Gynecol* 1989; 73:  
31 209–213.
7. El-Torky M, Giltman L, Maijub A. Uterine arteriovenous 32  
fistula. A case report. *J Reprod Med* 1986; 31: 283–286.
8. Borell U, Fernstrom J. Arteriovenous fistulae of the uterus and 33  
adnexae. *Acta Radiol* 1958; 49: 1–12.
9. Fornsman L, Lungberg J, Scherstein T. Conservative treatment 34  
of uterine arteriovenous fistula. *Acta Obstet Gynecol Scand*  
35 1982; 61: 85–87.
10. Vogelzang R, Nemcek A Jr, Skrtic Z, Gorrell J, Lurain J. Uter- 36  
ine arteriovenous malformations: primary treatment with ther-  
37 apeutic embolization. *J Vasc Interv Radiol* 1991; 2: 517–522.
11. Torres W, Stones P Jr, Thames F. Ultrasound appearance of 38  
pelvic arteriovenous malformation. *J Clin Ultrasound* 1979; 7:  
39 383–385.
12. Ginsberg N, Hammer R, Parihk S, Tamura R, Sabbagha R. 40  
Arteriovenous malformation of the uterus associated with  
41 missed abortion. *Ultrasound Obstet Gynecol* 1994; 4: 235–237. 42  
43  
44  
45  
46

1	QUERIES TO BE ANSWERED BY AUTHOR (SEE MARGINAL MARKS)	60
2		61
3	<b>IMPORTANT NOTE: Please mark your corrections and answers to these queries directly onto the</b>	62
4	<b>proof at the relevant place. Do NOT mark your corrections on this query sheet.</b>	63
5		64
6	<hr/>	65
7	Query No.    Query	66
8	<hr/>	67
9	Q1            Author to confirm location given for Upjohn is correct.	68
10	Q2            Author to confirm location given for BioSphere Medical, Inc. is correct.	69
11	<hr/>	70
12		71
13		72
14		73
15		74
16		75
17		76
18		77
19		78
20		79
21		80
22		81
23		82
24		83
25		84
26		85
27		86
28		87
29		88
30		89
31		90
32		91
33		92
34		93
35		94
36		95
37		96
38		97
39		98
40		99
41		100
42		101
43		102
44		103
45		104
46		105
47		106
48		107
49		108
50		109
51		110
52		111
53		112
54		113
55		114
56		115
57		116
58		117
59		118

UNCORRECTED PROOFS

# WILEY AUTHOR DISCOUNT CARD

As a highly valued contributor to Wiley's publications, we would like to show our appreciation to you by offering a **unique 25% discount** off the published price of any of our books\*.

To take advantage of this offer, all you need to do is apply for the **Wiley Author Discount Card** by completing the attached form and returning it to us at the following address:

The Database Group  
John Wiley & Sons Ltd  
The Atrium  
Southern Gate  
Chichester  
West Sussex PO19 8SQ  
UK

In the meantime, whenever you order books direct from us, simply quote promotional code **S001W** to take advantage of the 25% discount.

The newest and quickest way to order your books from us is via our new European website at:

**<http://www.wileyeurope.com>**

Key benefits to using the site and ordering online include:

- Real-time SECURE on-line ordering
- The most up-to-date search functionality to make browsing the catalogue easier
- Dedicated Author resource centre
- E-mail a friend
- Easy to use navigation
- Regular special offers
- Sign up for subject orientated e-mail alerts

So take advantage of this great offer, return your completed form today to receive your discount card.

Yours sincerely,



Verity Leaver  
E-marketing and Database Manager

#### \*TERMS AND CONDITIONS

This offer is exclusive to Wiley Authors, Editors, Contributors and Editorial Board Members in acquiring books (excluding encyclopaedias and major reference works) for their personal use. There must be no resale through any channel. The offer is subject to stock availability and cannot be applied retrospectively. This entitlement cannot be used in conjunction with any other special offer. Wiley reserves the right to amend the terms of the offer at any time.

# REGISTRATION FORM FOR 25% BOOK DISCOUNT CARD

To enjoy your special discount, tell us your areas of interest and you will receive relevant catalogues or leaflets from which to select your books. Please indicate your specific subject areas below.

<b>Accounting</b>	<input type="checkbox"/>	<b>Architecture</b>	<input type="checkbox"/>
• Public	<input type="checkbox"/>	<b>Business/Management</b>	<input type="checkbox"/>
• Corporate	<input type="checkbox"/>	<b>Computer Science</b>	<input type="checkbox"/>
<b>Chemistry</b>	<input type="checkbox"/>	• Database/Data Warehouse	<input type="checkbox"/>
• Analytical	<input type="checkbox"/>	• Internet Business	<input type="checkbox"/>
• Industrial/Safety	<input type="checkbox"/>	• Networking	<input type="checkbox"/>
• Organic	<input type="checkbox"/>	• Programming/Software	<input type="checkbox"/>
• Inorganic	<input type="checkbox"/>	Development	<input type="checkbox"/>
• Polymer	<input type="checkbox"/>	• Object Technology	<input type="checkbox"/>
• Spectroscopy	<input type="checkbox"/>	<b>Engineering</b>	<input type="checkbox"/>
<b>Encyclopedia/Reference</b>	<input type="checkbox"/>	• Civil	<input type="checkbox"/>
• Business/Finance	<input type="checkbox"/>	• Communications Technology	<input type="checkbox"/>
• Life Sciences	<input type="checkbox"/>	• Electronic	<input type="checkbox"/>
• Medical Sciences	<input type="checkbox"/>	• Environmental	<input type="checkbox"/>
• Physical Sciences	<input type="checkbox"/>	• Industrial	<input type="checkbox"/>
• Technology	<input type="checkbox"/>	• Mechanical	<input type="checkbox"/>
<b>Earth &amp; Environmental Science</b>	<input type="checkbox"/>	<b>Finance/Investing</b>	<input type="checkbox"/>
<b>Hospitality</b>	<input type="checkbox"/>	• Economics	<input type="checkbox"/>
<b>Genetics</b>	<input type="checkbox"/>	• Institutional	<input type="checkbox"/>
• Bioinformatics/Computational	<input type="checkbox"/>	• Personal Finance	<input type="checkbox"/>
Biology	<input type="checkbox"/>	<b>Life Science</b>	<input type="checkbox"/>
• Proteomics	<input type="checkbox"/>	<b>Landscape Architecture</b>	<input type="checkbox"/>
• Genomics	<input type="checkbox"/>	<b>Mathematics/Statistics</b>	<input type="checkbox"/>
• Gene Mapping	<input type="checkbox"/>	<b>Manufacturing</b>	<input type="checkbox"/>
• Clinical Genetics	<input type="checkbox"/>	<b>Material Science</b>	<input type="checkbox"/>
<b>Medical Science</b>	<input type="checkbox"/>	<b>Psychology</b>	<input type="checkbox"/>
• Cardiovascular	<input type="checkbox"/>	• Clinical	<input type="checkbox"/>
• Diabetes	<input type="checkbox"/>	• Forensic	<input type="checkbox"/>
• Endocrinology	<input type="checkbox"/>	• Social & Personality	<input type="checkbox"/>
• Imaging	<input type="checkbox"/>	• Health & Sport	<input type="checkbox"/>
• Obstetrics/Gynaecology	<input type="checkbox"/>	• Cognitive	<input type="checkbox"/>
• Oncology	<input type="checkbox"/>	• Organizational	<input type="checkbox"/>
• Pharmacology	<input type="checkbox"/>	• Developmental and Special Ed	<input type="checkbox"/>
• Psychiatry	<input type="checkbox"/>	• Child Welfare	<input type="checkbox"/>
<b>Non-Profit</b>	<input type="checkbox"/>	• Self-Help	<input type="checkbox"/>
		<b>Physics/Physical Science</b>	<input type="checkbox"/>

I confirm that I am a Wiley Author/Editor/Contributor/Editorial Board Member of the following publications:

SIGNATURE: .....

**PLEASE COMPLETE THE FOLLOWING DETAILS IN BLOCK CAPITALS:**

TITLE AND NAME: (e.g. Mr, Mrs, Dr) .....

JOB TITLE: .....

DEPARTMENT: .....

COMPANY/INSTITUTION: .....

ADDRESS: .....

.....

.....

.....

TOWN/CITY: .....

COUNTY/STATE: .....

COUNTRY: .....

POSTCODE/ZIP CODE: .....

DAYTIME TEL: .....

FAX: .....

E-MAIL: .....

**YOUR PERSONAL DATA**

We, John Wiley & Sons Ltd, will use the information you have provided to fulfil your request. In addition, we would like to:

1. Use your information to keep you informed by post, e-mail or telephone of titles and offers of interest to you and available from us or other Wiley Group companies worldwide, and may supply your details to members of the Wiley Group for this purpose.

Please tick the box if you do not wish to receive this information

2. Share your information with other carefully selected companies so that they may contact you by post, fax or e-mail with details of titles and offers that may be of interest to you.

Please tick the box if you do not wish to receive this information.

If, at any time, you wish to stop receiving information, please contact the Database Group ([databasegroup@wiley.co.uk](mailto:databasegroup@wiley.co.uk)) at John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, UK.

**E-MAIL ALERTING SERVICE**

We offer an information service on our product ranges via e-mail. If you do not wish to receive information and offers from John Wiley companies worldwide via e-mail, please tick the box .

This offer is exclusive to Wiley Authors, Editors, Contributors and Editorial Board Members in acquiring books (excluding encyclopaedias and major reference works) for their personal use. There should be no resale through any channel. The offer is subject to stock availability and may not be applied retrospectively. This entitlement cannot be used in conjunction with any other special offer. Wiley reserves the right to vary the terms of the offer at any time.

Ref: S001W

# Offprint order form



Journal title \_\_\_\_\_

Article reference number \_\_\_\_\_

Twenty-five offprints are supplied free of charge to the first named author, or the author named for correspondence. If you would like to purchase further offprints of your paper and journal copies, these are available at pre-publication prices in the quantities below. Only one contributor receives this form, so please ensure that you include the offprint and journal requirements for all the contributors. Offprint orders received after your corrected proofs have been returned, approved for publication, may be subject to a special reprint quotation as they may have to be printed separately and thus incur additional print set-up costs.

Article title \_\_\_\_\_

Billing address (if different from delivery address) \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

Postcode/Zip Code \_\_\_\_\_

Postcode/Zip Code \_\_\_\_\_

Telephone \_\_\_\_\_

Telephone \_\_\_\_\_

Fax \_\_\_\_\_

Fax \_\_\_\_\_

E-mail \_\_\_\_\_

E-mail \_\_\_\_\_

Note for USA authors: please do not use PO Box numbers as delivery addresses, as we cannot guarantee delivery.

## Offprint price list (based on cash with order)

Number of copies	1-4 pages	5-8 pages	9-12 pages	13-16 pages	17 pages and over
25	£75/\$125	£135/\$230	£195/\$330	£255/\$430	£315/\$535
50	£100/\$170	£180/\$305	£260/\$445	£340/\$580	£420/\$715
100	£130/\$220	£210/\$360	£290/\$495	£370/\$630	£460/\$780
200	£190/\$325	£290/\$495	£390/\$665	£490/\$835	£590/\$1000
300	£250/\$425	£370/\$630	£490/\$835	£610/\$1040	£730/\$1240
400	£310/\$530	£450/\$765	£590/\$1005	£730/\$1240	£870/\$1480
per extra 100	£60/\$105	£80/\$135	£100/\$170	£120/\$205	£140/\$235

Please **add** 10% to prices if payment is to be made later by invoice or purchase order

Number of pages	
Number of offprints required <b>25 Free+</b>	
Price (add 10% if payment is made by invoice or purchase order)	





COPYRIGHT TRANSFER AGREEMENT



Wiley Production No. \_\_\_\_\_

Date: \_\_\_\_\_

To: \_\_\_\_\_

Re: Manuscript entitled \_\_\_\_\_

(the "Contribution") for publication in *Ultrasound in Obstetrics & Gynecology* (the "Journal") published by John Wiley & Sons Ltd ("Wiley").

Thank you for submitting your contribution for publication. In order to expedite the publishing process and enable Wiley to disseminate your work to the fullest extent, we need to have this Copyright Transfer Agreement signed and returned to us as soon as possible. If the Contribution is not accepted for publication this Agreement shall be null and void.

**A. COPYRIGHT**

1. The Contributor assigns to the International Society of Ultrasound in Obstetrics and Gynecology ("ISUOG"), during the full term of copyright and any extensions or renewals of that term, all copyright in and to the Contribution, including but not limited to the right to publish, republish, transmit, sell, distribute and otherwise use the Contribution and the material contained therein in electronic and print editions of the Journal and in derivative works throughout the world, in all languages and in all media of expression now known or later developed, and to license or permit others to do so.
2. Reproduction, posting, transmission or other distribution or use of the Contribution or any material contained therein, in any medium as permitted hereunder, requires a citation to the Journal and an appropriate credit to the ISUOG as copyright owner and to Wiley as Publisher, suitable in form and content as follows: (Title of Article, Author, *Ultrasound in Obstetrics & Gynecology*, Volume/Issue Copyright © [year] International Society of Ultrasound in Obstetrics and Gynecology, first published by John Wiley & Sons Ltd.)

**B. RETAINED RIGHTS**

Notwithstanding the above, the Contributor or, if applicable, the Contributor's Employer, retains all proprietary rights other than copyright, such as patent rights, in any process, procedure or article of manufacture described in the Contribution, and the right to make oral presentations of material from the Contribution.

**C. OTHER RIGHTS OF CONTRIBUTOR**

The International Society of Ultrasound in Obstetrics and Gynecology grants back to the Contributor the following:

1. The right to share with colleagues print or electronic "preprints" of the unpublished Contribution, in form and content as accepted by Wiley for publication in the Journal. Such preprints may be posted as electronic files on the Contributor's own website for personal or professional use, or on the Contributor's internal university or corporate networks/intranet, or secure external website at the Contributor's institution, but not for commercial sale or for any systematic external distribution by a third party (eg: a listserver or database connected to a public access server). Prior to publication, the Contributor must include the following notice on the preprint: "This is a preprint of an article accepted for publication in *Ultrasound in Obstetrics & Gynecology* Copyright © (year) (International Society of Ultrasound in Obstetrics and Gynecology)". After publication of the Contribution by Wiley, the preprint notice should be amended to read as follows: "This is a preprint of an article published in [include the complete citation information for the final version of the Contribution as published in the print edition of the Journal]" and should provide an electronic link to the Journal's WWW site, located at the following Wiley URL: <http://www.interscience.wiley.com>. The Contributor agrees not to update the preprint or replace it with the published version of the Contribution.
2. The right, without charge, to photocopy or to transmit on-line or to download, print out and distribute to a colleague a copy of the published Contribution in whole or in part, for the Contributor's personal or professional use, for the advancement of scholarly or scientific research or study, or for corporate informational purposes in accordance with paragraph D2 below.
3. The right to republish, without charge, in print format, all or part of the material from the published Contribution in a book written or edited by the Contributor.
4. The right to use selected figures and tables, and selected text (up to 250 words) from the Contribution, for the Contributor's own teaching purposes, or for incorporation within another work by the Contributor that is made part of an edited work published (in print or electronic format) by a third party, or for presentation in electronic format on an internal computer network or external website of the Contributor or the Contributor's employer. The abstract shall not be included as part of such selected text.
5. The right to include the Contribution in a compilation for classroom use (course packs) to be distributed to students at the Contributor's institution free of charge or to be stored in electronic format in datarooms for access by students at the Contributor's institution as part of their course work (sometimes called "electronic reserve rooms") and for in-house training programmes at the Contributor's employer.

**D. CONTRIBUTIONS OWNED BY EMPLOYER**

1. If the Contribution was written by the Contributor in the course of the Contributor's employment (as a "work-made-for-hire" in the course of employment), the Contribution is owned by the company/employer which must sign this Agreement (in addition to the Contributor's signature), in the space provided below. In such case, the company/employer hereby assigns to the ISUOG, during the full term of copyright, all copyright in and to the Contribution for the full term of copyright throughout the world as specified in paragraph A above.

2. In addition to the rights specified as retained in paragraph B above and the rights granted back to the Contributor pursuant to paragraph C above, the ISUOG hereby grants back, without charge, to such company/employer, its subsidiaries and divisions, the right to make copies of and distribute the published Contribution internally in print format or electronically on the Company's internal network. Upon payment of the Publisher's reprint fee, the institution may distribute (but not re-sell) print copies of the published Contribution externally. Although copies so made shall not be available for individual re-sale, they may be included by the company/employer as part of an information package included with software or other products offered for sale or license. Posting of the published Contribution by the institution on a public access website may only be done with Wiley's written permission, and payment of any applicable fee(s).

**E. GOVERNMENT CONTRACTS**

In the case of a Contribution prepared under US Government contract or grant, the US Government may reproduce, without charge, all or portions of the Contribution and may authorise others to do so, for official US Government purposes only, if the US Government contract or grant so requires. (Government Employees: see note at end.)

**F. COPYRIGHT NOTICE**

The Contributor and the company/employer agree that any and all copies of the Contribution or any part thereof distributed or posted by them in print or electronic format as permitted herein will include the notice of copyright as stipulated in the Journal and a full citation to the Journal as published by Wiley.

**G. CONTRIBUTORS REPRESENTATIONS**

The Contributor represents that the Contribution is the Contributor's original work. If the Contribution was prepared jointly, the Contributor agrees to inform the co-Contributors of the terms of this Agreement and to obtain their signature(s) to this Agreement or their written permission to sign on their behalf. The Contribution is submitted only to this Journal and has not been published before, except for "preprints" as permitted above. (If excerpts from copyrighted works owned by third parties are included, the Contributor will obtain written permission from the copyright owners for all uses as set forth in Wiley's permissions form or in the Journal's Instructions for Contributors, and show credit to the sources in the Contribution.) The Contributor also warrants that the Contribution contains no libelous or unlawful statements, does not infringe on the right or privacy of others, or contain material or instructions that might cause harm or injury.

**Tick one box and fill in the appropriate section before returning the original signed copy to the Publisher**

**Contributor-owned work**

Contributor's signature \_\_\_\_\_ Date \_\_\_\_\_

Type or print name and title \_\_\_\_\_

Co-contributor's signature \_\_\_\_\_ Date \_\_\_\_\_

Type or print name and title \_\_\_\_\_

**Attach additional signature page as necessary**

**Company/Institution-owned work (made-for-hire in the course of employment)**

Contributor's signature \_\_\_\_\_ Date \_\_\_\_\_

Type or print name and title \_\_\_\_\_

Company or Institution  
(Employer-for Hire) \_\_\_\_\_

Authorised signature of Employer \_\_\_\_\_ Date \_\_\_\_\_

Type or print name and title \_\_\_\_\_

**US Government work**

Note to US Government Employees

A Contribution prepared by a US federal government employee as part of the employee's official duties, or which is an official US Government publication is called a "US Government work", and is in the public domain in the United States. In such case, the employee may cross out paragraph A1 but must sign and return this Agreement. If the Contribution was not prepared as part of the employee's duties or is not an official US Government publication, it is not a US Government work.

**UK Government work (Crown Copyright)**

Note to UK Government Employees

The rights in a Contribution by an employee of a UK Government department, agency or other Crown body as part of his/her official duties, or which is an official government publication, belong to the Crown. In such case, the Publisher will forward the relevant form to the Employee for signature.