



# Blood conservation and pain control in scoliosis corrective surgery: an online survey of UK practice.

Scott Bird, Neil McGill

## ► To cite this version:

Scott Bird, Neil McGill. Blood conservation and pain control in scoliosis corrective surgery: an online survey of UK practice.. *Pediatric Anesthesia*, 2010, 21 (1), pp.50. 10.1111/j.1460-9592.2010.03443.x . hal-00600131

**HAL Id: hal-00600131**

**<https://hal.science/hal-00600131>**

Submitted on 14 Jun 2011

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Pediatric Anesthesia

## Blood conservation and pain control in scoliosis corrective surgery: an online survey of UK practice.

Journal:	<i>Pediatric Anesthesia</i>
Manuscript ID:	PAN-2010-0321
Manuscript Type:	Original Paper
Date Submitted by the Author:	03-Aug-2010
Complete List of Authors:	Bird, Scott; Southampton University Hospital, Anaesthetics McGill, Neil; Southampton University Hospital, Anaesthetics
Key Words:	adolescent < Age, child < Age, blood transfusion < Hematology, acute < Pain, scoliosis < Orthopedics, survey

SCHOLARONE™  
Manuscripts

view

**Blood conservation and pain control in scoliosis corrective surgery: an online survey of UK practice.**

**S.Bird<sup>1</sup> and N. McGill<sup>1</sup>**

*<sup>1</sup>Department of Anaesthesia Southampton University Hospital, Southampton SO16 6YD.*

**Background.** Following discussions at national meetings the authors realised the diverse range of anaesthetic practice, in paediatric and adolescent scoliosis surgery, current in the U.K. This coupled with the paucity of research into the peri operative care of the scoliosis patient led to this national survey. We assessed this diversity using an online survey, with particular reference to pain control, thromboprophylaxis and blood conservation strategies. The aim of the survey was to provoke discussion and highlight areas of future research.

**Methods.** The names of anaesthetists specialised in paediatric and adolescent scoliosis surgery in the U.K. were collated and contacted via email, asking them if they would fill in a short email survey. Non responders were contacted a total of three times over a 6 month period. Of the 24 centres practicing paediatric and adolescent scoliosis surgery we received completed questionnaires from anaesthetists working in 21. A response rate of 88%.

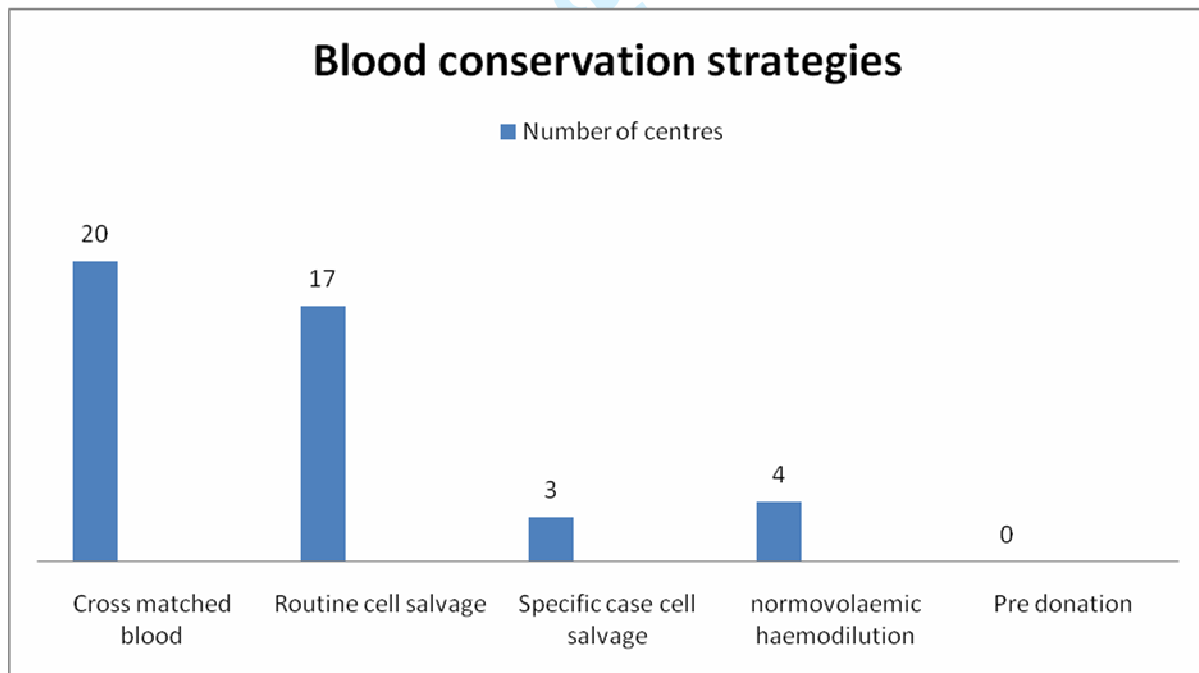
## Results.

### Blood Conservation

20 centres (95%) routinely cross-match blood. 17 centres (81%) routinely use cell salvage with a further 3 (14%) using it for specific cases. Only 4 centres (19%) advocated normovolaemic haemodilution, with no centres surveyed using pre donated blood. (figure 1)

Peri-operatively, 17 centres (81%) routinely used anti-fibrinolytics, all of whom use Tranexamic Acid. Reported dosing regimens showed an even wider variation than previously reported <sup>(1)</sup> with loading doses varying between 2-100mg/kg and infusions varying from 3-10mg/kg/hr.

Figure 1. Blood conservation strategies utilized by U.K. centres.

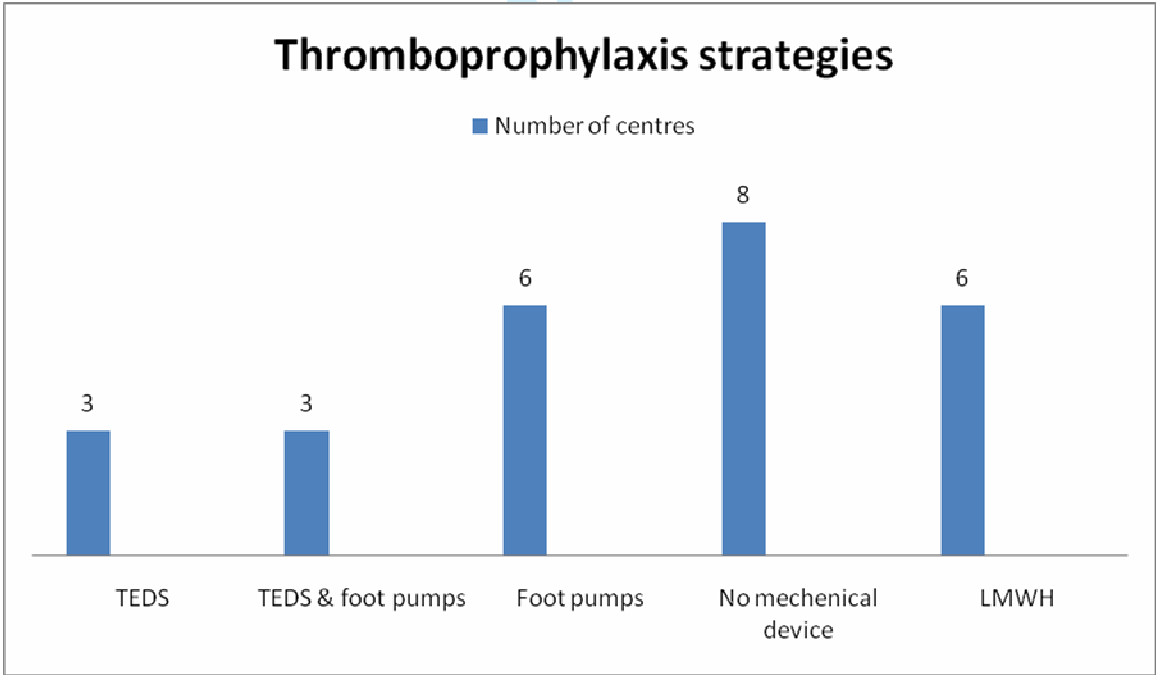


**Thromboprophylaxis**

Three centres (14%) used graduated compression devices (TEDS) alone, 3 centres (14%) TEDS and foot pumps, 6 centres (29%) foot pumps alone and 8 centres (38%) used no mechanical devices. Low molecular weight heparin (LMWH) was only used as part of a thromboprophylaxis regime in 6 centres (29%) (figure 2)

Those centres that advocated the use of LMWH showed wide variation in timing of therapy; some centers prescribing it the night before, others post operatively on the day of surgery, some 24 hours post surgery and one centre on day 2.

Figure2. Thromboprophylaxis strategies utilized by U.K. centres.



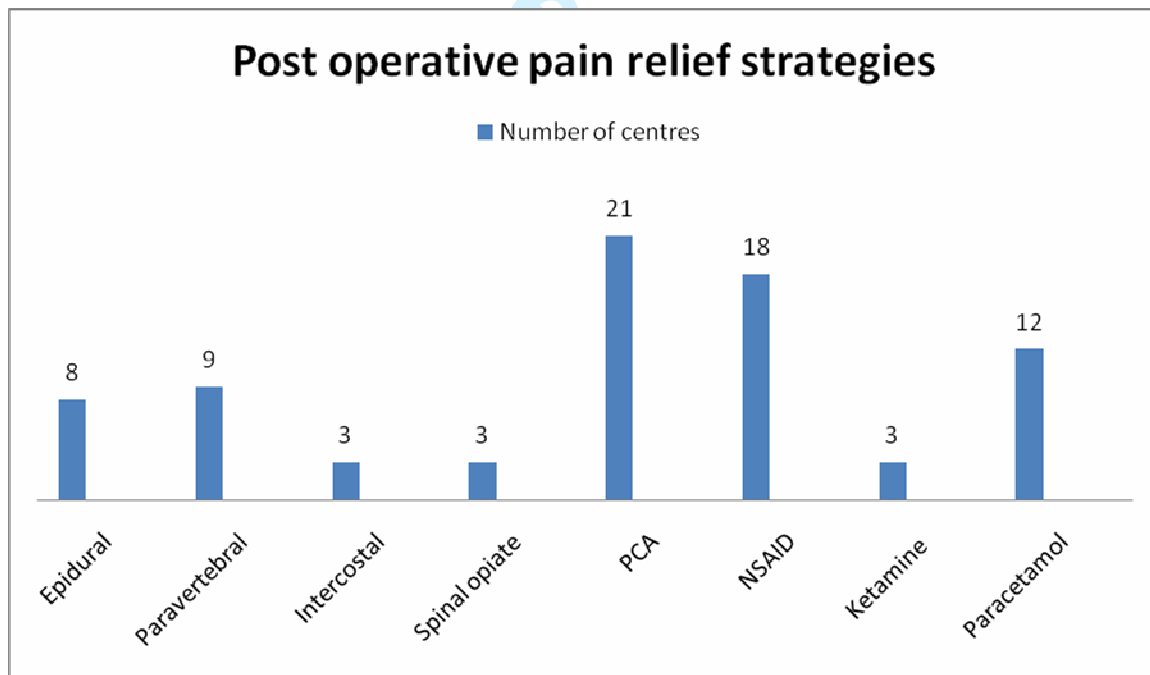
**Pain Control**

Regional: Epidural analgesia is routinely used in 8 centres (38%), of which 3 centres (14%) place 2 catheters and 2 centres (10%) use patient controlled epidural analgesia, all continue use

into the post operative period. Paravertebral blocks are used in 9 centres (43%), some with postoperative infusions. Three centres each (14%) use intercostal nerve blockade or spinal opioids.

Systemic: All respondents use patient or nurse controlled analgesia (PCA), most commonly morphine but also fentanyl and oxycodone. Ketamine infusions are used in 3 centres (14%). Four centres (19%) use intra operative clonidine as an adjunct. Non steroidal anti inflammatory drugs were avoided by 3 centres (14%). Regular paracetamol was prescribed routinely in 12 centres (57%) and all but 2 (90%) centres use remifentanyl peri-operatively. (Figure 3)

Figure3. Post operative pain relief strategies utilized by U.K. centres.



### Institutional factors

The majority of centres have 2-3 scoliosis surgeons (range 1- 5). Of whom most undertake posterior repairs more frequently than either anterior or anterior-posterior combined. There was

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

considerable spread when looking at total cases undertaken per annum. With 2 centres (10%) undertaking <25 cases, 7 centres (33%) undertaking 25 - 50 cases, 7 centres (33%) undertaking 50 - 100 cases, 4 centres (19% ) undertaking 100 – 200 cases and only one centre (5%) reporting over 200 cases a year. There is facility for High care beds (HDU and or ITU) in 90 % of the centres.

**Preoperative investigation**

Whilst 20 centres (95%) routinely cross-match blood, 14 centres (67%) would order pulmonary lung function tests, 2 centres (10%) routinely order arterial blood gases and 3 centres (14%) Echocardiograms with one centre (5%) ordering none of the above.

**Perioperative anaesthetic techniques**

17 centres (81%) utilised hypotensive anaesthesia with 5 of these (29%) defining this as an active process using a combination of agents including remifentanyl, labetolol, GTN, clonidine and vapour.

The maintenance agent of choice was divided almost equally between vapour, 9 centres (43%) and TIVA, 12 centres (57%) techniques.

With regards intra operative monitoring, all centres routinely place arterial lines and 16 centres (76%) CVP lines. 3 centres (14%) also use oesophageal Doppler and one utilises LiDCO.

For intra operative spinal cord monitoring SSEP was used in 19 centres (90%) although other monitors are also utilised. BIS or other such devises were used in only 2 centres.

1  
2  
3 18 centres (86%) extubate their patients in theatre with 2 centres (10%) experiencing respiratory  
4 failure, as defined by  $\text{PaO}_2 < 8.0$  or  $\text{PaCO}_2 > 6.0$ , in the first 24 hours in more than 5% of their  
5  
6 patients.  
7  
8  
9

10  
11  
12  
13 **Discussion.** The results from our survey show the expected variation in numbers and types of  
14 procedures undertaken across the centres in the U.K. As was expressed in the invitation to  
15 undertake the survey our intent was not to promote conformity but to stimulate debate.  
16  
17  
18  
19

20  
21  
22  
23 **Blood conservation.** The area of greatest clinical variability seen in this survey was the dosing  
24 regimens used for Tranexamic Acid. With loading doses varying between 2-100mg/kg and  
25 infusions varying from 3-10mg/kg/hr. The Cochrane database review of Antifibrinolytic agents  
26 for reducing blood loss in scoliosis surgery in children in 2008<sup>(2)</sup> stated that antifibrinolytic drugs  
27 reduced blood loss and the amount of blood transfused. However the fact that only six studies  
28 met their inclusion criteria and that no comment on dosing regimens was made shows that there  
29 is scope for further research into this area.  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40

41  
42 **Thromboprophylaxis.** Another area of diversity demonstrated in our survey was that of  
43 thromboprophylaxis. Not only was there a broad range of devices used, some in isolation and  
44 others in combination, some centres reported not using any mechanical compression pre or post  
45 operatively. LMWH were used in only 6 centres and even then showed great variation in their  
46 time of administration. The evidence again is sparse and conflicting; a recent study<sup>(3)</sup> looked at  
47 adult patients undergoing spinal deformity surgery who all received post operative  
48 pharmacological thromboprophylaxis. Here the authors stated an overall incidence of pulmonary  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 embolism (PE) as 2.4%, with an increased incidence in those patients undergoing anterior spinal  
4  
5 surgery. When comparing their results with an historical control group who had no  
6  
7 thromboprophylaxis they concluded that pharmacological thromboprophylaxis probably doesn't  
8  
9 have a role after posterior spinal surgery but could lower the incidence of PE after anterior spinal  
10  
11 surgery. A recent pilot <sup>(4)</sup> which screened children for deep vein thrombosis (DVT) after  
12  
13 posterior spinal fusion for idiopathic scoliosis, looked at 40 patients and demonstrated two  
14  
15 transient small clots. The authors stated that prophylaxis for venous thrombosis should not be  
16  
17 recommended. However they added that larger series were required, they did not mention  
18  
19 anterior spinal surgery.  
20  
21  
22  
23  
24  
25  
26

27 **Pain control.** The frequency and severity of post op pain was not reviewed in this survey,  
28  
29 however the survey showed that eight different types of post operative pain relief were utilised,  
30  
31 some in isolation but many in combination which perhaps is evidence of the potential difficulties  
32  
33 in treating post operative pain in this cohort of patients. A recent meta-analysis <sup>(5)</sup> looked at the  
34  
35 evidence to recommend the use of epidural analgesia with parenteral opioids vs intravenous  
36  
37 opioids only. The authors stated that epidural analgesia is beneficial to patients in terms of  
38  
39 improving pain control and reducing side effects, however there was not enough data available to  
40  
41 state the impact of this technique on respiratory depression, length of stay or mortality. With the  
42  
43 suggestion that these patients may be presenting with chronic pain <sup>(6)</sup> later in life the need for  
44  
45 research into the best perioperative analgesic regime is even more pressing.  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## Conclusion

The results from our survey show wide variation in blood conservation, thromboprophylaxis and pain control techniques in scoliosis correction surgery in the U.K. National multi-centered research is required to define best practice.

**Key words:** Survey, Anaesthetic practice, paediatric, scoliosis surgery, blood loss, pain control

## References

1. P.R. Smith, I. Crighton. BJA 2009; 103: 329P
2. Tzortzopoulou A, Cepeda MS, Schumann R, Carr DB. Antifibrinolytic agents for reducing blood loss in scoliosis surgery in children. Cochrane Database Syst Rev. 2008; Jul 16;(3):CD006883.
3. Pateder DB, Gonzales RA, Kebaish KM, Antezana DF, Cohen DB, Chang JY, Kostuik JP. Pulmonary embolism after adult spinal deformity surgery. Spine (Phila Pa 1976). 2008 Feb 1;33(3):301-5.
4. Kaabachi O, Alkaissi A, Koubaa W, Aloui N, Toumi Nel H. Screening for deep venous thrombosis after idiopathic scoliosis surgery in children: a pilot study. Paediatric Anaesth. 2010 Feb;20(2):144-9.
5. Taenzer AH, Clark C. Efficacy of postoperative epidural analgesia in adolescent scoliosis surgery: a meta-analysis. Paediatr Anaesth. 2010 Feb;20(2):135-43.

6. Upasani VV, Caltoun C, Petcharaporn M, Bastrom TP, Pawelek JB, Betz RR, Clements DH, Lenke LG, Lowe TG, Newton PO. Adolescent idiopathic scoliosis patients report increased pain at five years compared with two years after surgical treatment. Spine (Phila Pa 1976). 2008 May 1;33(10):1107-12.

**Appendix A**

Hospital taking part in survey, alphabetical order.

Addenbrookes

Alderhey

Birmingham childrens hospital

Freeman hospital, Newcastle

Frenchey

GOS

Guys and St Thomas

James cook hospital, middlesbrough

Leeds general

Manchester childrens

Norfolk and Norwich

North Staffordshire

Oxford Radcliff & Nuffield orthopaedic

Queens medical centre, Nottingham

Royal Devon and Exeter

Royal national orthopaedic hospital

Royal orthopaedic hospital

Royal Victoria, Belfast

RHSC, Edinburgh

Southampton

Taunton

For Peer Review



# COPYRIGHT TRANSFER AGREEMENT

Date: 3/8/10 Contributor name: SCOTT BIRD  
Contributor address: 16 SPRING UALZ SWANMORE SO32 2PH  
Manuscript number (if known): \_\_\_\_\_  
Re: Manuscript entitled BLOOD CONSERVATION AND PAIN CONTROL IN SCOLIOSIS  
CORRECTIVE SURGERY: AN ONLINE SURVEY OF UK PRACTICE (the "Contribution")  
for publication in PEDIATRIC ANESTHESIA (the "Journal")  
published by WILEY - BLACKWELL ("Wiley-Blackwell").

Dear Contributor(s):  
Thank you for submitting your Contribution for publication. In order to expedite the editing and publishing process and enable Wiley-Blackwell to disseminate your Contribution to the fullest extent, we need to have this Copyright Transfer Agreement signed and returned as directed in the Journal's instructions for authors as soon as possible. If the Contribution is not accepted for publication, or if the Contribution is subsequently rejected, this Agreement shall be null and void. **Publication cannot proceed without a signed copy of this Agreement.**

## A. COPYRIGHT

1. The Contributor assigns to Wiley-Blackwell, during the full term of copyright and any extensions or renewals, all copyright in and to the Contribution, and all rights therein, including but not limited to the right to publish, republish, transmit, sell, distribute and otherwise use the Contribution in whole or in part 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 final Contribution in whole or in part in any medium by the Contributor as permitted by this Agreement requires a citation to the Journal and an appropriate credit to Wiley-Blackwell as Publisher, and/or the Society if applicable, suitable in form and content as follows: (Title of Article, Author, Journal Title and Volume/Issue, Copyright © [year], copyright owner as specified in the Journal). Links to the final article on Wiley-Blackwell's website are encouraged where appropriate.

## 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.

## C. PERMITTED USES BY CONTRIBUTOR

1. **Submitted Version.** Wiley-Blackwell licenses back the following rights to the Contributor in the version of the Contribution as originally submitted for publication:
  - a. After publication of the final article, the right to self-archive on the Contributor's personal website or in the Contributor's institution's/employer's institutional repository or archive. This right extends to both intranets and the Internet. The Contributor may not update the submission version or replace it with the published Contribution. The version posted must contain a legend as follows: This is the pre-peer reviewed version of the following article: FULL CITE, which has been published in final form at [Link to final article].
  - b. The right to transmit, print and share copies with colleagues.
2. **Accepted Version.** Re-use of the accepted and peer-reviewed (but not final) version of the Contribution shall be by separate agreement with Wiley-Blackwell. Wiley-Blackwell has agreements with certain funding agencies governing reuse of this version. The details of those relationships, and other offerings allowing open web use, are set forth at the following website: <http://www.wiley.com/go/funderstatement>. NIH grantees should check the box at the bottom of this document.

## 3. Final Published Version.

Wiley-Blackwell hereby licenses back to the Contributor the following rights with respect to the final published version of the Contribution:

- a. Copies for colleagues. The personal right of the Contributor only to send or transmit individual copies of the final published version in any format to colleagues upon their specific request provided no fee is charged, and further-provided that there is no systematic distribution of the Contribution, e.g. posting on a listserve, website or automated delivery.
- b. Re-use in other publications. The right to re-use the final Contribution or parts thereof for any publication authored or edited by the Contributor (excluding journal articles) where such re-used material constitutes less than half of the total material in such publication. In such case, any modifications should be accurately noted.
- c. Teaching duties. The right to include the Contribution in teaching or training duties at the Contributor's institution/place of employment including in course packs, e-reserves, presentation at professional conferences, in-house training, or distance learning. The Contribution may not be used in seminars outside of normal teaching obligations (e.g. commercial seminars). Electronic posting of the final published version in connection with teaching/training at the Contributor's institution/place of employment is permitted subject to the implementation of reasonable access control mechanisms, such as user name and password. Posting the final published version on the open Internet is not permitted.
- d. Oral presentations. The right to make oral presentations based on the Contribution.

## 4. Article Abstracts, Figures, Tables, Data Sets, Artwork and Selected Text (up to 250 words).

- a. Contributors may re-use unmodified abstracts for any non-commercial purpose. For on-line uses of the abstracts, Wiley-Blackwell encourages but does not require linking back to the final published versions.
- b. Contributors may re-use figures, tables, data sets, artwork, and selected text up to 250 words from their Contributions, provided the following conditions are met:
  - (i) Full and accurate credit must be given to the Contribution.
  - (ii) Modifications to the figures, tables and data must be noted. Otherwise, no changes may be made.
  - (iii) The reuse may not be made for direct commercial purposes, or for financial consideration to the Contributor.
  - (iv) Nothing herein shall permit dual publication in violation of journal ethical practices.

**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 Wiley-Blackwell, 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, Wiley-Blackwell hereby grants back, without charge, to such company/employer, its subsidiaries and divisions, the right to make copies of and distribute the final published Contribution internally in print format or electronically on the Company's internal network. Copies so used may not be resold or distributed externally. However the company/employer may include information and text from the Contribution as part of an information package included with software or other products offered for sale or license or included in patent applications. Posting of the final published Contribution by the institution on a public access website may only be done with Wiley-Blackwell's written permission, and payment of any applicable fee(s). Also, upon payment of Wiley-Blackwell's reprint fee, the institution may distribute print copies of the published Contribution externally.

**E. GOVERNMENT CONTRACTS**

In the case of a Contribution prepared under U.S. Government contract or grant, the U.S. Government may reproduce, without charge, all or portions of the Contribution and may authorize others to do so, for official U.S. Govern-

ment purposes only, if the U.S. Government contract or grant so requires. (U.S. Government, U.K. Government, and other government employees: see notes at end)

**F. COPYRIGHT NOTICE**

The Contributor and the company/employer agree that any and all copies of the final published version 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-Blackwell.

**G. CONTRIBUTOR'S REPRESENTATIONS**

The Contributor represents that the Contribution is the Contributor's original work, all individuals identified as Contributors actually contributed to the Contribution, and all individuals who contributed are included. 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 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. (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-Blackwell'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 upon the rights (including without limitation the copyright, patent or trademark rights) or the privacy of others, or contain material or instructions that might cause harm or injury.

**CHECK ONE BOX:**

☒ Contributor-owned work

ATTACH ADDITIONAL SIGNATURE  
PAGES AS NECESSARY

Contributor's signature

Date 3/8/10

Type or print name and title

SCOTT BIRD (Dr)

Co-contributor's signature

N. A. M. C. I. A. P.

Date 3/8/10

Type or print name and title

NEURFILL (Dr)

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

Company or Institution (Employer-for-Hire)

Date

Authorized signature of Employer

Date

☐ U.S. Government work

**Note to U.S. Government Employees**

A contribution prepared by a U.S. federal government employee as part of the employee's official duties, or which is an official U.S. Government publication, is called a "U.S. Government work," and is in the public domain in the United States. In such case, the employee may cross out Paragraph A.1 but must sign (in the Contributor's signature line) and return this Agreement. If the Contribution was not prepared as part of the employee's duties or is not an official U.S. Government publication, it is not a U.S. Government work.

☐ U.K. Government work  
(Crown Copyright)

**Note to U.K. Government Employees**

The rights in a Contribution prepared by an employee of a U.K. 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. U.K. government authors should submit a signed declaration form together with this Agreement. The form can be obtained via <http://www.opsi.gov.uk/advice/crown-copyright/copyright-guidance/publication-of-articles-written-by-ministers-and-civil-servants.htm>

☐ Other Government work

**Note to Non-U.S., Non-U.K. Government Employees**

If your status as a government employee legally prevents you from signing this Agreement, please contact the editorial office.

☐ NIH Grantees

**Note to NIH Grantees**

Pursuant to NIH mandate, Wiley-Blackwell will post the accepted version of Contributions authored by NIH grant-holders to PubMed Central upon acceptance. This accepted version will be made publicly available 12 months after publication. For further information, see [www.wiley.com/go/nihmandate](http://www.wiley.com/go/nihmandate).