

Short-term outcomes of dry pars plana posterior capsulotomy and anterior vitrectomy in paediatric cataract surgery using 25-gauge instruments

Y Huang, L Xie

State Key Laboratory Cultivation Base, Shandong Provincial Key Laboratory of Ophthalmology, Shandong Eye Institute, Qingdao, China

Correspondence to

Professor L Xie, Shandong Eye Institute, 5 Yanerdao Road, Qingdao 266071, PR China; lixin_xie@yahoo.com

Accepted 11 October 2009
Published Online First
3 December 2009

ABSTRACT

Aim To evaluate the safety and efficacy of dry pars plana posterior capsulotomy and anterior vitrectomy in paediatric cataract surgery using 25-gauge instruments.

Methods A consecutive series of 57 paediatric patients (80 eyes) who underwent dry pars plana posterior capsulotomy and anterior vitrectomy with 25-gauge devices after in-the-bag intraocular lens (IOL) implantation were retrospectively reviewed.

Results The mean follow-up period was 13.7 (SD 8.3) months. All IOL were well centred in the capsular bags. No intraoperative complications were noted to be attributable to the small-gauge instruments. Postoperative hypotony (intraocular pressure <8 mm Hg) was observed in two eyes (2.5%), which spontaneously recovered within 3 days. Eight eyes (10%) had light fibrin reactions and two eyes (2.5%) had mild posterior synechiae. No reopacification of the visual axis, IOL capture, vitreous prolapse, choroidal detachment or retinal detachment was found during the follow-up.

Conclusions Dry pars plana posterior capsulotomy with anterior vitrectomy using 25-gauge instruments is safe and effective for the management of posterior lens capsule and anterior vitreous in surgery for paediatric cataract.

Management of the posterior capsule has been challenging during paediatric cataract surgery, especially when intraocular lens (IOL) implantation is involved.¹ Many techniques have been introduced to prevent postoperative reopacification of the visual axis, including primary posterior capsulotomy or central capsulectomy with or without anterior vitrectomy, optic capture through posterior continuous curvilinear capsulorhexis (PCCC), and pars plana posterior capsulotomy combined with anterior vitrectomy using 20-gauge devices.^{1–7} Moreover, 25-gauge vitrectomy systems for vitreoretinal surgery have been advocated for their advantages in producing small self-sealing wounds, limiting surgical trauma, reducing postoperative inflammation and accelerating postoperative recovery.^{8–9} In this study, we describe our initial surgical experience and report the safety and feasibility of using 25-gauge vitrectomy instruments to manage the posterior lens capsule and anterior vitreous during cataract surgery in children.

METHODS

We retrospectively reviewed a consecutive series of 57 paediatric cataract patients (80 eyes) who underwent anterior continuous curvilinear capsu-

lorhexis, cataract extraction, IOL implantation in the capsular bag, pars plana posterior capsulotomy and pars plana anterior vitrectomy using a 25-gauge vitrectomy system. All surgeries were performed at Shandong Eye Institute between July 2006 and July 2008. Eyes with any other ocular abnormality (eg, microphthalmos, coloboma or glaucoma) were excluded from this study.

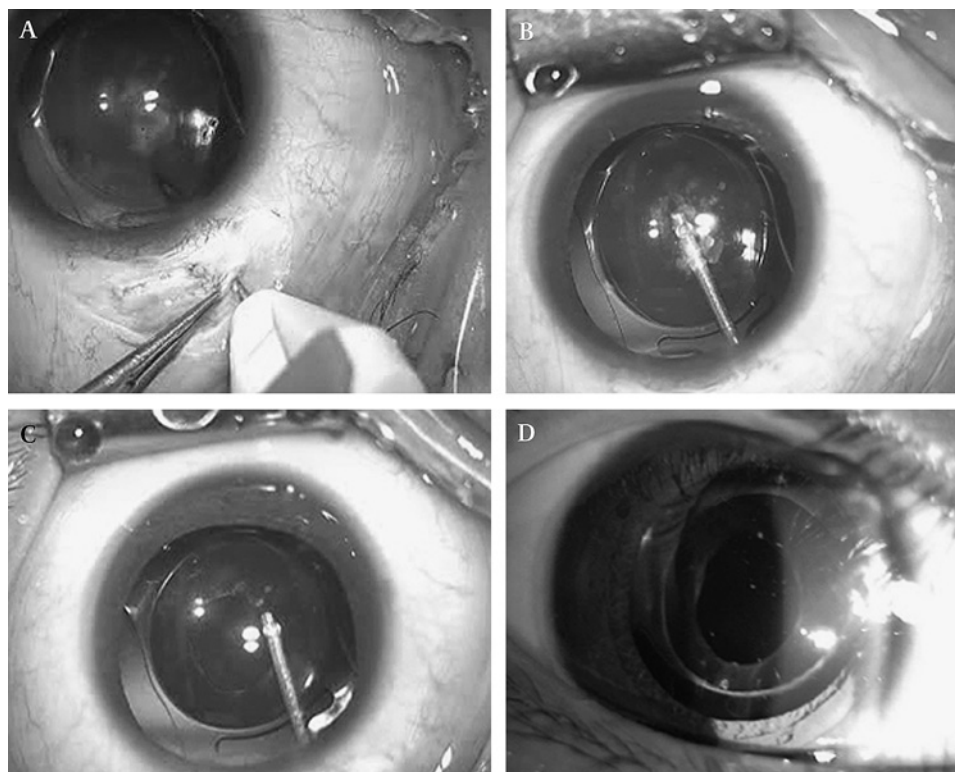
Information for each patient was recorded, including age at the time of surgery, sex, preoperative and postoperative visual acuity, intraocular pressure (IOP), intraoperative or postoperative complications, types of IOL, length of follow-up and types of secondary intervention. Visual acuity was assessed with an illiterate E chart. IOP was measured with an applanation tonometre (Tono-Pen XL, Medtronic Solan, Jacksonville, Florida, USA).

Surgical technique

All operations were performed under general anaesthesia by one surgeon (LX). One hour before surgery, the pupil was dilated with Mydrin-P eye drops (phenylephrine hydrochloride and tropicamide; Santen, Osaka, Japan). After conjunctival dissection and a 3.2-mm scleral tunnel incision was made using a diamond knife (Meyco, Anton Meyer Ltd, Biel, Switzerland), a viscoelastic agent was injected into the anterior chamber and anterior continuous curvilinear capsulorhexis was created using a needle and forceps. The nucleus was hydrodissected, before the lens material was removed by irrigation aspiration (I/A) or phacemulsification for dense nuclear cataracts. The capsular bag was filled with the viscoelastic substance, and then a foldable IOL (Akreos Adapt; Bausch and Lomb, San Dimas, California, USA) was implanted in the capsular bag, with the viscoelastic material remaining in the anterior chamber.

The pars plana entry site was made at the 11 o'clock position using a bevelled trocar with no microcannula (figure 1). Because the pars plana is not well developed in young children, the sclerotomy sites should be chosen according to the patient's age.¹⁰ In our series, the sclerotomy was placed 2.5 mm posterior to the limbus in patients aged 18–24 months, 3.0 mm in those aged 2–6 years and 3.5 mm in those older than 6 years. After inserting a 25-gauge cutter, dry pars plana posterior capsulotomy combined with anterior vitrectomy was performed. A stopwatch was used to record the time needed for vitrectomy and posterior capsule manipulation. The vitrectomy

Figure 1 A 5-year-old cataract patient. Intraoperative video frames showing (A) the entry site of the trocar without a microcannula after in-the-bag implantation of the intraocular lens; (B) the entry site of the 25-gauge vitreous cutter and the viscoelastic substance remained in the anterior chamber; and (C) the operated eye after removal of the central posterior capsule and adjacent anterior vitreous. (D) Slit-lamp microscopic photograph showing the smooth and intact posterior curvilinear capsulorhexis at 3 months after surgery.



cutter was set at a rate of 1000 cuts per minute and vacuum aspiration was set at 250 mm Hg. The posterior capsulotomy was created approximately 4.0 mm in diameter. After removal of the central posterior capsule and adjacent anterior vitreous, the 25-gauge cutter was removed without scleral suturing. Acetylcholine chloride was injected into the anterior chamber to constrict the pupil. The viscoelastic substance was removed by I/A with the balanced salt solution bottle set at 50 cm through the 3.2-mm scleral incision, which was then sutured with 10-0 nylon suture. The conjunctival incision was closed by electric coagulation.

After surgery, the children were given Tobradex eye drops (tobramycin 0.3% and dexamethasone 0.1%; Alcon, Fort Worth, Texas, USA) four times a day for 2 weeks and pranoprofen ophthalmic solution (Senju, Osaka, Japan) four times a day for 2 months. The follow-up visits were scheduled at 1, 3 and 7 days, 2 weeks, 1 month, and as necessary thereafter. Postoperative evaluation included visual acuity testing, IOP measurement, slit-lamp examination and fundus examination. The uncooperative children were examined under sedation with the aid of an operating microscope. Hypotony was defined as an IOP of less than 8 mm Hg. Four patients who were older than 8 years and could cooperate had ultrasound biomicroscopy (model 840; Zeiss-Humphrey, San Leandro, California, USA) at 3 days, 1, 2, 3 weeks, 1 and 3 months after surgery.

RESULTS

The data are presented as mean (SD). The mean age of these children was 6.3 (3.1) years (range 18 months to 14 years), and the mean follow-up period was 13.7 (8.3) months (range 3–28). Thirty-six patients were male and 21 were female. Twenty-three patients (46 eyes) had bilateral congenital cataracts, 18 patients (18 eyes) had unilateral congenital cataracts, 14 patients (14 eyes) had traumatic cataracts, one patient (one eye) had developmental cataract, and one patient (one eye) had complicated

cataract with uveitis. The patients' clinical data are summarised in table 1.

All surgical procedures were uneventful and all eyes had well-centred IOL in the bags. The mean vitrectomy time was 38.8 (11.2) s (range 20–60) for 40 eyes in 30 patients. The mean IOP was 14.2 (3.2) mm Hg (range 7–23), 14.6 (5.6) mm Hg (range 6–44), 14.2 (3.8) mm Hg (range 8–26), 14.1 (3.7) mm Hg (range 6–24), 13.5 (3.7) mm Hg (range 8–23), and 13.3 (2.8) mm Hg (range 8–21) preoperatively, at 1, 3 days, 1, 2 weeks postoperatively and at the final visit, respectively. There was no statistically significant difference between preoperative and postoperative IOP (paired-samples *t* test, *p*=0.732, 0.955, 1.000, 0.209, 0.050, respectively). Transient postoperative hypotony occurred in two congenital cataract eyes (7 mm Hg and 6 mm Hg, respectively) on the first postoperative day and spontaneously recovered within 3 days; there was no leakage through the scleral incision. Moreover, one eye had an IOP of 44 mm Hg on day 1, which was controlled with medication within 3 days.

Five of 64 eyes (7.8%) with congenital cataracts and three of 14 eyes (21.4%) with traumatic cataracts had fibrin reactions in the anterior chamber, which completely resolved in one week. Mild pigment dispersion on the IOL was observed in two eyes. Little aqueous flare and few aqueous cells could be found at 2 weeks. Mild posterior synechiae occurred in two eyes (3.1%) with congenital cataracts. No pupil capture or iris incarceration was detected. No eye had central axis reopacification at the final follow-up. We did not find any postoperative complications attributed to the pars plana vitrectomy, such as choroidal detachment and retinal detachment. Fluorescein angiography was not performed, and the fundus examination did not reveal cystoid macular oedema.

On the third postoperative day, we observed a mild gap by ultrasound biomicroscopy at the 25-gauge trocar site (figure 2). The gap gradually became smaller and healed completely at 4 weeks after surgery. No ciliochoroidal detachment or membranous stalks were found at the sclerotomy site.

Clinical science

Table 1 Summary of patients' information

Age (years)	Total no of eyes	Types of cataract					Fibrinolytic activity	Posterior synechiae	Hypotony	Mean follow-up days (SD)
		Nuclear	Lamellar	Posterior	Traumatic	Other				
<3	5	3	1	0	0	1	3	1	0	16.0 (4.1)
3–5	37	12	5	8	6	6	2	1	0	12.8 (8.7)
6–8	17	9	1	3	4	0	2	0	1	14.5 (7.7)
>8	21	7	2	4	4	4	1	0	1	14.2 (9.9)

Among the patients (59 eyes) who can read an illiterate E chart at the final follow-up, best-corrected visual acuity was better than 20/40 in 38 eyes (64.4%), 20/50 to 20/70 in eight eyes (13.6%), 20/80 to 20/200 in 11 eyes (18.6%) and 20/400 or worse in two eyes (3.4%). Postoperative best-corrected visual acuity improved in 57 eyes (96.6%) and remained unchanged in two eyes (3.4%) because of amblyopia.

DISCUSSION

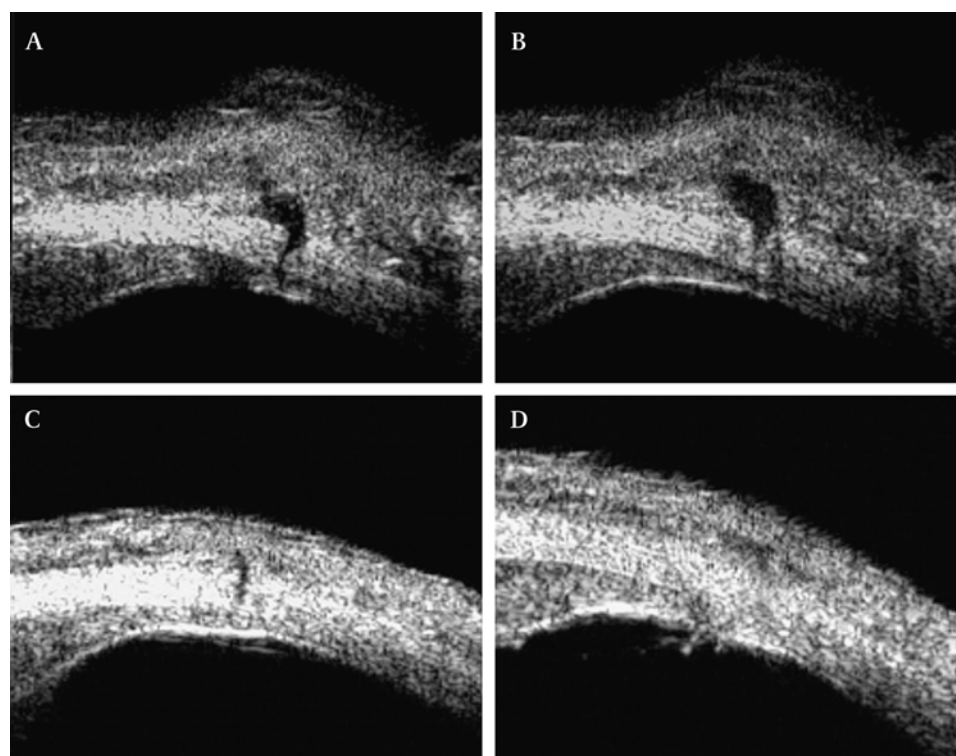
PCCC combined with anterior vitrectomy has been the 'gold standard' in cataract surgery for children, especially for those younger than 5 years.¹¹ Several surgical approaches have been advocated to deal with the posterior capsule and anterior vitreous at the time of the initial cataract surgery for the prevention of posterior capsular opacification. The anterior approach (limbal–scleral) has been popular in primary posterior capsulectomy and vitrectomy,^{12 13} but its weakness should not be neglected. PCCC does pose a technical challenge and requires a comparatively long learning curve. Even though care is taken, vitreous incarceration to the scleral wound could not be completely avoided when the vitrectomy probe is removed. Moreover, it is difficult to put an IOL in an unintact capsule after PCCC and anterior vitrectomy. Another approach to perform posterior capsulectomy with vitrectomy is via the pars plana using 20-gauge instruments,² but the scleral incision is required to be sutured. Furthermore, large instruments may cause a high risk of ciliochoroidal detachment, vitreous incar-

ceration and postoperative inflammatory response in young children. Therefore, anterior limbal vitrectomy is preferred by most paediatric cataract surgeons, whereas pars plana vitrectomy is usually performed for secondary procedure in pseudophakic eyes with visual axis opacification.

Anterior segment surgery in paediatric patients using 25-gauge instruments has previously been reported. Cacciatori and Arpa¹⁴ showed the safety and feasibility of using 25-gauge vitrectomy systems via a transcorneal approach to manipulate secondary pupillary membrane or vitreous prolapse. By the same vitrectomy technique, Lam *et al*¹⁵ carried out posterior capsulotomy in 10 pseudophakic eyes with posterior capsular opacification. The present study demonstrates the safety and feasibility of using a 25-gauge vitrectomy system for pars plana posterior capsulectomy combined with anterior vitrectomy in paediatric cataracts.

The potential advantages of the 25-gauge instruments in surgery for paediatric cataract are apparent. First, small instruments are easier to manipulate in the narrow palpebral fissures and small eyes of children, so that we can easily perform IOL capsular fixation before posterior capsulectomy and anterior vitrectomy. Second, a dry technique with 25-gauge instruments can help to maintain a stable anterior chamber during the surgical procedure, despite the high intravitreal pressure in children's eyes.¹⁴ Ideally, one should aim for a 4-mm posterior capsulotomy, which is circular and centric. This approach may provide easier control of the size of posterior capsulorhexis than

Figure 2 Ultrasound biomicroscopic images of the 25-gauge port in one patient on day 3 (A), day 7 (B), week 3 (C) and month 1 (D) postoperatively showing gradual healing of the sclerotomy. No ciliochoroidal detachment or membranous stalks were found at the sclerotomy site.



the anterior approach. Third, the postoperative inflammation seems to be mild. Little aqueous flare and few aqueous cells were observed at 2 weeks after surgery in our series. Finally, it is not time-consuming for anterior segment surgeons to learn.

The surgical technique specifically related to the 25-gauge transconjunctival sutureless vitrectomy uses a microcannula with a bevelled trocar to create a scleral incision. Because of the step-up diameter from the trocar to the cannula at the transitional area, it is extremely difficult to puncture an eye immediately after phacoemulsification when the IOP is relatively low. However, it is convenient to create a scleral incision of less than 0.5 mm, which allows a large safety margin against hypotony, using a trocar without a cannula, even in children with low scleral rigidity.

Hypotony due to wound deshiscence is a common complication after surgical treatment with 25-gauge transconjunctival sutureless vitrectomy.^{15 16} In this study, mild hypotony occurred in two eyes (2.5%), but the IOP spontaneously recovered to a normal range within 3 days. No presence of leakage through the scleral incision may be attributed to the following reasons. First, the time for anterior vitrectomy is much shorter than vitreoretinal surgery, so there can be less damage to the scleral port. Second, the scleral port is covered by a conjunctival flap at the end of surgery. Third, only one scleral incision is needed because no irrigation cannula or endo-illumination is placed.

In the current study, no vitreous haemorrhage, retinal detachment or ciliochoroidal detachment occurred, although the pars plana approach may increase the risks. Keshavamurthy *et al*¹⁷ reported that a 25-gauge sclerotomy site in a 25-year-old male patient healed within 2 weeks. Our observations by ultrasound biomicroscopy showed that complete healing of sclerotomy may take 1 month in children.

Furthermore, the dry pars plana approach allows surgeons to create a large capsulotomy after IOL implantation. In our series, no reopacification of the visual axis was observed during the follow-up, which may be owed to the efficient cutting of the posterior capsule and anterior vitreous using a 25-gauge vitrectomy cutter. This surgical technique can ensure that the IOL is securely placed in the bag before the posterior capsulotomy and minimises the chance of a vitreous wick to the anterior wound. There were no intraoperative and postoperative complications associated with this technique in this study. We recommend using 25-gauge vitrectomy instruments in the management of the posterior capsule during paediatric cataract surgery. Further investigation of this procedure with a longer follow-up is needed.

Acknowledgements The authors would like to thank Professor Xiaoguang Dong for her critical support as a retinal surgeon and Ms Ping Lin for her editorial assistance.

Funding This study was supported by the National Natural Science Foundation of China (30600698), National 11th Five-Year Science and Technology Supporting Projects (2006BAI02B04), and the Qingdao Municipal Science and Technology Bureau (07-2-3-8-jch).

Competing interests None.

Patient consent Obtained.

Ethics approval Ethics approval was obtained from the Ethics Committee of Shandong Eye Institute.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1. **Wilson ME.** Management of aphakia in childhood. AAO Focal Points: Clinical Module for Ophthalmologists. *Module Ophthalmol* 1999;**17**:1–15.
2. **Buckley EG,** Klombers LA, Seaber JH, *et al.* Management of the posterior capsule during pediatric intraocular lens implantation. *Am J Ophthalmol* 1993;**115**:722–8.
3. **Kugelberg M,** Zetterstrom C. Pediatric cataract surgery with or without anterior vitrectomy. *J Cataract Refract Surg* 2002;**28**:1770–15.
4. **BenEzra D,** Cohen E. Posterior capsulotomy in pediatric cataract surgery. The necessity of a choice. *Ophthalmology* 1997;**104**:2168–74.
5. **Hamdi E,** Doganay S, Evereklioglu C, *et al.* Retrospective comparison of surgical techniques to prevent secondary opacification in pediatric cataracts. *J Pediatr Ophthalmol Strabismus* 2000;**37**:294–8.
6. **Gimbel HV.** Posterior capsulorhexis with optic capture in pediatric cataract and intraocular lens surgery. *Ophthalmology* 1996;**103**:1871–5.
7. **Fenton S,** O'Keefe M. Primary posterior capsulorhexis without anterior vitrectomy in pediatric cataract surgery: longer term outcome. *J Cataract Refract Surg* 1999;**25**:763–7.
8. **Hwang JU,** Yoon YH, Kim DS, *et al.* Combined phacoemulsification, foldable intraocular lens implantation, and 25-gauge transconjunctival sutureless vitrectomy. *J Cataract Refract Surg* 2006;**32**:727–31.
9. **Chong LP,** McCormick M, Deboer C, *et al.* A self-stabilizing lens ring for 25-gauge vitrectomy surgery. *Am J Ophthalmol* 2007;**143**:350–1.
10. **Hairston RJ,** Maguire AM, Vitale S, *et al.* Morphometric analysis of pars plana development in humans. *Retina* 1997;**17**:135–8.
11. **Vasavada A.** Posterior capsule management in congenital cataract surgery. In: Masket A, Crandall AS, eds. *Atlas of cataract surgery*. London: Martin Dunitz Ltd, 1999:281–90.
12. **Koch DD,** Kohnen T. A retrospective comparison of techniques to prevent secondary cataract formation following posterior chamber intraocular lens implantation in infants and children. *Trans Am Ophthalmol Soc* 1997;**95**:351–60.
13. **Xie L,** Dong X, Cao J, *et al.* Congenital cataract extraction with intraocular lens implantation in children. [in Chinese] *Zhonghua Yan Ke Za Zhi* 1998;**34**:99–102.
14. **Cacciatori M,** Arpa P. Surgical technique for anterior segment surgery in pediatric patients using 25-gauge instruments. *J Cataract Refract Surg* 2006;**32**:562–4.
15. **Lam DS,** Fan DS, Mohamed S, *et al.* 25-Gauge transconjunctival sutureless vitrectomy system in the surgical management of children with posterior capsular opacification. *Clin Experiment Ophthalmol* 2005;**33**:495–8.
16. **Fujii GY,** de Juan E Jr., Humayun MS, *et al.* Initial experience using the transconjunctival sutureless vitrectomy system for vitreoretinal surgery. *Ophthalmology* 2002;**109**:1814–20.
17. **Keshavamurthy R,** Venkatesh P, Garg S. Ultrasound biomicroscopy findings of 25 G transconjunctival sutureless (TSV) and conventional (20G) pars plana sclerotomy in the same patient. *BMC Ophthalmol* 2006;**6**:7.



Short-term outcomes of dry pars plana posterior capsulotomy and anterior vitrectomy in paediatric cataract surgery using 25-gauge instruments

Y Huang and L Xie

Br J Ophthalmol 2010 94: 1024-1027 originally published online December 3, 2009

doi: 10.1136/bjo.2008.154633

Updated information and services can be found at:
<http://bjo.bmj.com/content/94/8/1024>

These include:

References

This article cites 16 articles, 0 of which you can access for free at:
<http://bjo.bmj.com/content/94/8/1024#BIBL>

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections

Articles on similar topics can be found in the following collections

[Paediatrics](#) (335)
[Lens and zonules](#) (752)
[Ophthalmologic surgical procedures](#) (1115)
[Retina](#) (1458)

Notes

To request permissions go to:
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:
<http://group.bmj.com/subscribe/>